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A revision of the Morinaceae (Magnoliophyta-Dipsacales)

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A revision of the Morinaceae (Magnoliophyta – Dipsacales)

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Contents

Synopsis

The group of species comprising the genus *Morina* is reviewed, and support is established from the fields of comparative morphology, embryology, cytology, and palynology, to justify their recognition as a distinct family, Morinaceae J. Agardh, related to the Dipsacaceae. Three clearly defined groups are recognised

within *Morina* sensu lato and, as a consequence, the sections *Acanthocalyx* DC. and *Cryptothladia* Bunge are elevated to generic status. Three new combinations under *Acanthocalyx* and five under *Cryptothladia* are made, and a new species *C. ludlowii* is described. Thirteen species are recognised as occurring in the family.

Introduction

This study was begun by one of us (J.F.M.C.) and, after a lapse of some years, was resumed by both authors. Much of the detailed examination of specimens, measurement of organs, and description of taxa was done by one author (M.J.C.), but the conclusions and consequent taxonomy are the result of close collaboration and joint decision. So that future botanical literature will not be unnecessarily burdened by dual author citations, we have decided that only one of us (M.J.C.) will appear as the author of the new taxa and combinations. Unless otherwise stated, all the specimens cited have been seen by the authors.

The Morinaceae includes a range of species that present fascinating problems in relationships both within and outside the group. It is hoped that this revision will not only stimulate further research, but will also encourage discerning plantsmen to grow a range of species beyond the relatively well-known and quite widely cultivated *Morina longifolia*.

Historical summary

The genus *Morina* was first described by Tournefort in 1703, in honour of Ludovic Morin, a doctor of medicine of Paris and a member of the Academy of Sciences of that city. It was subsequently renamed *Diototheca* – a reference to the ear-like lobes of the calyx – by Vaillant in 1724 (subsequently misspelt by later authors *Diolotheca*, *Diodotheca*, and *Dictotheca*), and placed by him in his class Dipsacées, between *Pterocephalus* and *Valeriana*. In both cases the concepts were based on *Morina orientalis carlinae folio*, the only species known at the time and now known as *Morina persica* L.

The genus passed into the era of binomial nomenclature in the first edition of *Species Plantarum* (1753), when Linnaeus based his concept on his treatment in *Hortus Cliffortianus* (1738), and beyond that on Tournefort's (1703) original publication. In 1820, Rafinesque separated *Morina* and *Diototheca* (misspelt by him as *Diolotheca*) from the Dipsacaceae as the new family Morinidia, and considered this to be more nearly related to the Valerianaceae. Coulter in 1824 included *Morina* in the Dipsacaceae, although he recognised many differences, and de Candolle in 1830 continued to regard it as a member of that family, a view that was followed by Bentham & Hooker in 1873.

Spach in 1841 classified *Morina* in the Dipsacaceae, but in a footnote says it has many affinities with the Valerianaceae, and ought to be regarded as a monogeneric family between the Valerianaceae and the Dipsacaceae. Bunge (1852) divided the genus into three sections: *Cryptothladia* Bunge – *M. parviflora* only; *Diotocalyx* DC. – comprising *M. persica, M. elegans, M. longifolia, M. polyphylla, M. lehmanniana*, and *M. coulteriana*; and *Acanthocalyx* DC. – consisting of *M. nana* only. Van Tieghem (1909) recognised the Morinaceae J. Agardh as a separate family, and distinguished it from Dipsacaceae by a number of morphological characters, pointing out that this left the Dipsacaceae as a much more homogenous family.

In 1938, Pai reviewed the Chinese species of *Morina*, recognising six species in two sections (*Acanthocalyx* and *Diotocalyx*). He discussed the relationships of the additional species that had been found as a result of the exploration of western China, notably by Forrest, Handel-Mazzetti, and the French missionary collectors.

Embryological and cytological studies by Pouques in 1949, Vijayaraghavan & Sarveshwari in 1968, and Kamelina in 1976 and 1977 provide strong evidence for the retention of the Morinaceae as a separate family, as do recent palynological studies by Blackmore & Cannon (1983). In her thesis Verlaque (1976) separated the Morinaceae from the Dipsacaceae on cytological grounds, and considered its origins to lie within the Valerianaceae, while in her later publication (Verlaque 1977), she tabulates the differences between all three families in morphology, cytology, and phytogeography.

Authors of major reviews of the flowering plants during the last 20 years have remained divided as to whether or not to recognise the Morinaceae. Wagenitz (1964), Hutchinson (1973), Heywood (1978), and Cronquist (1981) all include *Morina* in the Dipsacaceae, but agree that many anomalous characters are involved. Thorne (1976) prefers to retain the Morinaceae, and Takhtajan (1954) notes that it is a distinct family and refers to the work of Vijayaraghavan & Sarveshwari (1968) and Kamelina & Yakovlev (1974), stating that the work of the last authors demonstrates that it is near the Caprifoliaceae.

Relationships of Morina sensu lato (Morinaceae) within the Dipsacales

1. Morphology

It is generally agreed that *Morina sensu lato* must be placed in the Dipsacales, probably in the Dipsacaceae, or in the Valerianaceae, or between them. There are, however, many difficulties in placing it in either family, or even in regarding it as an intermediate. Many authors have placed *Morina* in the Dipsacaceae, the most outstanding similarity being the possession by both of involucels. Van Tieghem (1909) and others have pointed out that this character is not confined to the Dipsacaceae, and occurs also in some genera of the Valerianaceae, some Compositae, as well as in the Nyctaginaceae. Morphologically, *Morina sensu lato* is set apart from the Dipsacaceae by the possession of a verticillate inflorescence, whorled leaves (not in *Acanthocalyx*), the nature and form of the involucel and calyx, the aestivation of the corolla, the insertion of the stamens (and staminodes) in 2 ranks, the ovary with 3 united carpels with 2 obsolete, and the 6-veined achene. It resembles the Valerianaceae in the number of carpels, the zygomorphic corolla, and in some cytological characters (see account of cytology). The Valerianaceae and Dipsacaceae are usually separated by the reduction or sometimes lack of a conspicuous involucel in the Valerianaceae, the type of inflorescence, and the tricarpellate or bicarpellate ovary. Table 1 summarises the differences between the two families and *Morina sensu lato*.

Table 1 Summary of morphological differences between *Morina sensu lato* and the Dipsacaceae and Valerianaceae.

Morina sensu lato	Dipsacaceae	Valerianaceae
Leaves often whorled (not *Acanthocalyx*)	Leaves opposite	Leaves opposite (sometimes all basal)
Inflorescence verticillate	Inflorescence capitulate	Inflorescence cymose
Involucel 12-nerved (formed from fusion of 4 bracteoles)	Involucel 8-nerved (formed from fusion of 2 bracteoles)	Involucel usually absent (8-nerved in *Triplostegia*)
Calyx zygomorphic (2-lobed or sheathing)	Calyx actinomorphic or obsolete	Calyx actinomorphic or obsolete
Corolla lobes in bud with posterior lobes overlapping the 2 lateral lobes of anterior lip	Corolla lobes of bud with 2 lateral lobes of anterior lip overlapping the posterior lobes	
Stamens 2 (with 2 staminodes) or 4 of 2 differing lengths	Stamens 4 – all equal	Stamens 1, 2, 3 or 4 equal
Ovary of 3 united carpels – 2 obsolete	Ovary of 2 united carpels – 1 obsolete	Ovary of 3 united carpels – 2 reduced and empty or obsolete
Achene 6-veined	Achene 8-veined	Achene 8-veined
Nectaries at base of filaments	Nectaries round base of style	Nectaries often in spur or sac at base of corolla

2. Embryology

The relationships of *Morina sensu lato* with the Dipsacaceae was extensively studied by Vijayaraghavan & Sarveshwari (1968). They concluded that *M. longifolia* resembles the Dipsacaceae in only a few embryological features, such as the dicotyledonous type of anther wall development, the anatropous ovule, a *Polygonum* type of embryo sac, and the cellular endosperm. It differs in many other characters, such as a persistent middle layer in the anther, secretory anther tapetum, pollen grains shed at the 2-celled stage, absence of integumentary vascular bundles, persistent pollen tube, ephemeral uninucleate antipodal cells, ruminate endosperm, transverse division of the zygote, and Solenad type of embryogeny. They considered that there were so many major differences that *Morina* could not be considered as a genus of the Dipsacaceae. They made no reference to possible relationships with other groups of the Dipsacales. However, Crété (1963) stated that both Dipsacaceae and Valerianaceae could be referred to the Seneciad type of embryogeny, which is far removed from the Solenad in his classification. Table 2 summarises the embryological differences between *Morina longifolia* and the Dipsacaceae.

Table 2 Summary of embryological and related characters (after Vijayaraghavan & Sarveshwari 1968).

Feature	*Morina longifolia*	Dipsacaceae
Anther wall	Dicotyledonous type	Dicotyledonous type
Endothecium	Fibrous	Fibrous
Middle layer	Persistent	Ephemeral
Tapetum	Secretory	Periplasmodial
Microspore tetrad	Tetrahedral or isobilateral	Tetrahedral
Shedding stage of pollen	2-celled	3-celled
Staminodes	Present	Absent
Ovule	Anatropous, unitegmic and tenuinucellar	Anatropous, unitegmic and tenuinucellar
Integumentary vascular bundles	Absent	Present
Hypostase	Present but no cavities	Present, cavities contain yellow liquid
Embryo sac	*Polygonum* type	*Polygonum* type
Antipodal cell	3-nucleate	3, uni or binucleate
Endosperm	Cellular, ruminate	Cellular, non-ruminate
Pollen tube	Persistent	Not persistent
Zygote	Divides by transverse wall	Divides by vertical wall
Embryogeny	Solenad type	Piperad type
Testa	Only outer epidermis persists as a flimsy layer	Not known

3. Cytology

The following chromosome counts have been recorded for *Morina sensu lato*:

Morina persica L.	2n = 34	Kachidze (1929) and Verlaque (1976 & 1977)
Morina longifolia Wallich ex DC.	2n = 34	
Morina kokanica Regel	2n = 34	Verlaque (1976 & 1977)

In the Dipsacaceae, base numbers of $x = 5,7,8,9$, and 10 are known with various polyploids, but 2n = 34 appears nowhere in the lists. A similar situation is recorded for the Valerianaceae, with base numbers of $x = 7,8,9$, and 11. The early count noted by Risse (1929) for *Morina longifolia*

as $2n = 16$ has not been substantiated, and must be regarded as dubious in the absence of further support. Poucques (1949) considered *Morina* to differ from the Dipsacaceae in the homogenous, euchromocentric nucleus, and in the number and form of the chromosomes, remarking on their very small size. He recorded the resting nucleus to be 6–7μ, with one nucleolus. Verlaque (1976 & 1977) studied three species of *Morina* and confirmed the findings of Poucques (1949). She found the chromosomes at metaphase to be 0·7–1·5μ, differing markedly in size from the Dipsacaceae (1–5μ) and the Valerianaceae (0·7–4μ). The centromere was scarcely visible (more or less visible in the Valerianaceae and strongly marked in the Dipsacaceae). The resting nucleus was homogenous and euchromocentric in both *Morina* and the Valerianaceae, but granulo-reticulate in the Dipsacaceae. She concluded that the origin of *Morina* should be looked for in the Valerianaceae. Cronquist (1981) referred to fibrous thickenings being present in all layers of the anther and connective in *Morina*, but only in the endothecium and sometimes the endodermis in the Dipsacaceae, and the sperms of *Morina* as having a little cytoplasm, whilst those of the Dipsacaceae are naked.

4. Palynology*
by S. Blackmore

Morinaceae pollen, which has been studied by Erdtman (1945, 1960*a*), Vinokurova (1959), and Blackmore & Cannon (1983), is morphologically distinctive and diverse. Three main pollen types, based on light microscopy of acetolysed (Erdtman, 1960*b*) pollen, are distinguished here (Fig. 1).

1a. Pollen without prominent equatorial protrusions, ectoapertures colpate. — *Acanthocalyx*-type
1b. Pollen with three prominent equatorial protrusions, ectoapertures porate:
  2a. Equatorial protrusions domed, internal outline of pollen hour-glass shaped. — *Cryptothladia* type
  2b. Equatorial protrusions funnel shaped, internal outline of pollen similar to external. — *Morina* type

Acanthocalyx type

Pollen tricolporate; triangular in polar view with the colpi in the rounded angles, subrhomboidal in equatorial view. Ectoapertures broad colpi one third as long as polar axis, endoapertures transverse colpi fused into a continuous equatorial band (zonorate). Exine thick, 6 μm at poles increasing to 10 μm at colpus margins; sexine spongy, without distinct columellae; tectum smooth with sparse microperforations. Polar axis 120–150 μm long, equatorial axis 100–125 μm.

Occurs in all species of *Acanthocalyx*.

Cryptothladia type

Pollen tripororate; rounded to triangular in polar view, prolate in equatorial view with prominent domed equatorial protrusions. Ectoapertures pores situated in the equatorial protrusions, endoapertures transverse colpi fused to form a narrow equatorial band (zonorate) flanked by very marked thickening of the nexine. Exine thick, 5 μm at the poles, 12 μm at the apertures; sexine spongy, thinner than nexine except at poles. Tectum smooth with scattered microperforations towards the equator. Polar axis 100–120 μm long, equatorial axis 55–70 μm (including protrusions).

Occurs in all species of *Cryptothladia* with some variation in the thickening of the sexinous walls of the protrusions and the size of pores.

Morina type

Pollen tripororate; rounded to triangular in polar view, prolate to nearly cylindrical in equatorial view with large funnel shaped equatorial protrusions prominent in either orientation. Ectoapertures pores at the mouth of each funnel shaped protrusion, endoapertures pores, sometimes with a very slight thinning of the inner nexine surface between them. Exine thick, 6 μm at poles increasing to 12 μm at equator; sexine and nexine equal at poles, nexine much thicker at equator. Tectum smooth at poles but often with two parallel bands of verrucae between each

*While this paper was in press, a paper by Dr R. Verlaque entitled 'Contribution à l'étude du genre *Morina* L.' appeared in *Pollen Spores* **25**: 143 – 162 (1983). This presents a review of the palynology, and although we cannot comment on it here, the reference is included for the convenience of later workers.

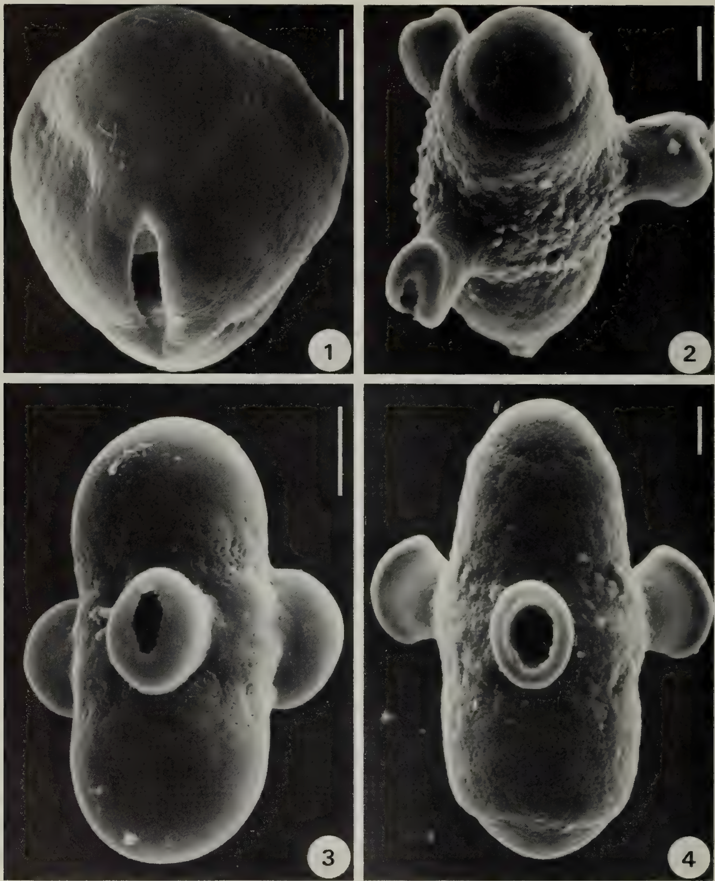

Fig. 1 Scanning electron micrographs of pollen types. Scale lines 20 μm.

1. *Acanthocalyx*-type, *A. nepalensis* (*Polunin, Sykes & Williams* 4536), slightly oblique equatorial view showing a colpate ectoaperture.
2. *Morina*-type, *M. persica* (*Davis, Dodds & Cetik* 19068), slightly oblique polar view showing verrucate ornamentation at equator.
3. *Cryptothladia*-type, *C. chinensis* (*Licent* 4548), equatorial view showing domed apertural protrusions.
4. *Morina*-type, *M. coulteriana* (*Vassiljeva* 5487), equatorial view showing funnel shaped apertural protrusions.

protrusion, microperforations more numerous towards the equator. Polar axis 150–270 μm long, equatorial axis 120–160 μm (including protrusions).

Occurs in all species of *Morina sensu stricto* with some variation in ornamentation, size, and shape.

Discussion

Pollen grains of Morinaceae differ from those of the Dipsacaceae in having spongy rather than columellate sexine, lacking operculae over the apertures, and in their unusual pre-germinative processes (Blackmore & Cannon, 1983). The zonorate endoapertures of two of the Morinaceae pollen types have no counterpart in the Dipsacaceae and are probably secondarily absent from the third pollen type. Similarly the domed and funnel shaped protrusions of *Cryptothladia* and *Morina sensu stricto* are unlike any apertural structures in the Dipsacaceae.

5. Conclusions

Major differences in morphology, palynology, embryology, and cytology have been shown to occur between *Morina sensu lato* (now regarded by us as three quite distinct genera, *Morina, Cryptothladia*, and *Acanthocalyx*), and the other members of the Dipsacales. The verticillate flower arrangement, the nature and form of the calyx, the androecium, and the zygomorphic ovary and achene are perhaps the most significant morphological features in this respect. The pollen is most unusual, showing few similarities with any other, either within the Dipsacales or with that of any other order of flowering plants. By palynological standards, these features alone strongly suggest recognition at the family level. Embryological and cytological studies have been made, so far as is known, only on members of the genus *Morina sensu stricto*, but it seems probable that *Cryptothladia* would resemble *Morina* in these characters, while the position of the less-closely related *Acanthocalyx* is not clear. Further wide-ranging research on these to genera would be most welcome. The weight of evidence from these four fields is very much in favour of the recognition of the Morinaceae as a distinct family within the Dipsacales.

Genera of the Morinaceae

The genus *Morina* has often been separated into two or three taxa (de Candolle (1830), Bunge (1852), van Tieghem (1909)) solely on grounds of morphology. Our studies on the comparative morphology of the group, and especially of its remarkable palynology, have convinced us that the Morinaceae is best considered to comprise three quite distinct genera.

Acanthocalyx differs from the other two genera in so many ways, that differences are easier to list than similarities. The most striking features are leaf arrangement, calyx shape, corolla shape, stamen number, and achene shape. Table 3 summarises these distinctions.

Table 3 Characters distinguishing *Acanthocalyx* from *Cryptothladia* and *Morina sensu stricto*.

Acanthocalyx	*Cryptothladia* and *Morina sensu stricto*
Leaves opposite	Leaves whorled
Flowers in close verticels to subcapitate	Flowers in well-separated verticels or in ± cylindrical spikes of verticels
Calyx mouth obliquely cut, often with 2 lateral and 3 (rarely 1) posterior teeth, not laminate	Calyx distinctly 2-lobed, laminate
Corolla ± 2-lipped, lobes often nearly equal	Corolla markedly zygomorphic, 2-lipped, lobes unequal
Stamens 4	Stamens 2, with 2 sterile stamens or minute staminodes
Nectary dome shaped, regular	Nectary with 3 lobes or with 2 irregularly lobed nectaries

Diotocalyx, the section recognised by de Candolle in contrast to his section *Acanthocalyx*, is here divided between the genera *Morina sensu stricto* and *Cryptothladia*. These genera are separated by the size and shape of the corolla, the shape and position of the staminodes or sterile stamens, the number and shape of the nectaries, and the pollen characters already described in detail. Table 4 summarises the major morphological differences.

Table 4 Morphological characters distinguishing *Morina sensu stricto* and *Cryptothladia*. See Fig. 2.

Cryptothladia	*Morina sensu stricto*
Corolla equalling or shorter than the calyx	Corolla much exceeding the calyx
Corolla 2–4 lobed (sometimes scarcely 5-lobed), limb scarcely expanded, posterior lip entire, slightly toothed or barely 2-lobed	Corolla clearly 5-lobed, limb expanded, posterior lip markedly 2-lobed, anterior lip markedly 3-lobed
Sterile stamens 2, lobes equalling or exceeding those of the fertile stamens, at the base of the corolla tube or a short way above	Staminodes 2, minute, much smaller than the fertile stamens, attached in the corolla throat just below the fertile stamens
Flowers probably cleistogamous	Flowers not obviously cleistogamous

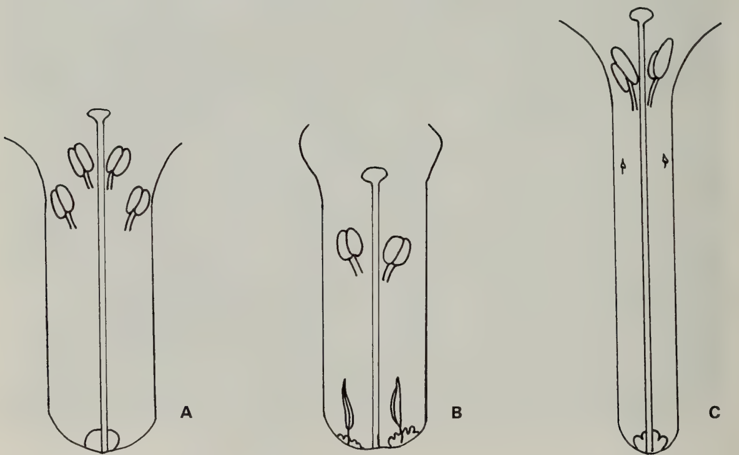

Fig. 2 Diagram showing relative positions of fertile stamens, sterile stamens, and staminodes in (A) *Acanthocalyx*, (B) *Cryptothladia*, and (C) *Morina*.

Systematic treatment

Morinaceae J. Agardh, *Theoria systematis plantarum*: 234 (1858).
Morinidia Raf. in *Annls gén. Sci. phys. Brusc.* **6**: 88 (1820).
Type genus: *Morina* L.

Perennial herbs with rootstocks often covered with the remains of old leafbases. Leaves opposite or whorled, exstipulate, often spiny, the petioles often connate, forming loose

cylindrical sheaths. Flowers hermaphrodite, zygomorphic, in verticillasters or subcapitulate heads of biparous cymes. Involucel (epicalyx) of 4 fused bracteoles, smooth, with few – numerous spiny teeth or setae, 12 nerved. Calyx epigynous, cupular, with an obliquely cut mouth, or 2-lobed. Corolla tubular, scarcely to markedly 2-lipped, lobes 5, spreading, or 2–5 scarcely opening, the 2 lateral lobes of the anterior lip overlapping the median and the 2 posterior lobes overlapping them in bud. Stamens 4, all fertile, borne near the corolla mouth, one pair above the other; or with 2 fertile borne near the corolla mouth or halfway up the tube, and 2 sterile stamens (staminodes) borne at the base of the corolla or halfway up the tube. Anthers introrse, 2-celled, the lobes subequal or markedly unequal, opening longitudinally. Ovary inferior, 1-locular, formed by the fusion of 3 carpels, 6-veined, adherent to the calyx tube; ovule solitary, pendulous, style slender, stigma simple. Fruit dry, indehiscent, enclosed in the involucel and surmounted by the persistent calyx.

Morinaceae differs from Dipsacaceae in its often whorled leaves, the flowers in cymose verticillasters (sometimes subcapitulate, but almost always with at least one detached lower verticell), the venation and form of the involucel, aestivation, and the 6-veined ovary. It also differs in many detailed palynological and embryological features and in chromosome numbers. These are detailed in the appropriate introductory sections.

Key to the genera

1a. Stamens 4; calyx limb oblique; plants not thistle-like .... **I. Acanthocalyx** (p. 9)
1b. Stamens 2 plus 2 staminodes; calyx limb 2-lipped; plants thistle-like:
  2a. Corolla up to 1 cm, almost hidden by the much longer calyx, weakly lobed with 2 or 4 major lobes; staminodes at base of corolla tube (⅓ way up the tube in *C. chinensis*) .... **II. Cryptothladia** (p. 15)
  2b. Corolla 2–5 cm long, well exserted from the calyx, strongly 5-lobed; staminodes borne ½ way up corolla tube .... **III. Morina** (p. 24)

See Figs 4, 6, and 9.

I. ACANTHOCALYX (DC.) M. Cannon, stat. nov.

Morina Section *Acanthocalyx* DC., *Prod.* **4**: 644 (1830).
Type species: *Acanthocalyx nepalensis* (D.Don) M. Cannon

Plants perennial, with a woody rootstock, often covered with the remains of old leaf bases. *Leaves* opposite and decussate, linear, lanceolate or ovate, with or without spines or short setae. Petioles joined to form a sheath, usually with 2 lines of hairs continued down the internode. Uppermost leaves often more spiny at the base. *Inflorescence* subcapitulate, often with one or more whorls of flowers below the primary head. *Bracts* free, connate or sheathing at the base. *Flowers* sessile, shorter than the bracts, at least at the base. *Involucel* campanulate, very fragile and papery at anthesis, enlarging and becoming more coriaceous in fruit, persistent, with few to numerous teeth. *Calyx* cylindrical, the mouth obliquely cut, with a ventral fissure, often with 2 lateral and 3 posterior subspinose teeth, the laterals sometimes overlapping the fissure and becoming sheathing. *Corolla* cylindrical, somewhat swollen below the limb with two posterior and 3 anterior spreading lobes. *Stamens* 4, ± equal, inserted just below the swollen part of the corolla tube, scarcely emergent from it, anthers introrse, sub-equal. *Nectary* small, spherical at the base of the corolla tube. *Style* equalling or exceeding corolla tube, stigma disc-shaped. *Ovary* unilocular, ovule pendulous. *Achenes* smooth or rugose, apex somewhat cup-shaped.

Three species of *Acanthocalyx* are recognised by us: *A. nepalensis*, widely distributed in Nepal, but spreading into Bhutan, Yunnan, Sichuan, and Xizang, *A. alba* (including *Morina leucoblephara* Hand.-Mazz.), occurring mainly in western China and Xizang, and *A. delavayi*, distributed mainly in Yunnan, Sichuan, and Gansu. See Fig. 3.

Fig. 3 Distribution of *Acanthocalyx* species: *A. nepalensis* (●), *A. delavayi* (▲), *A. alba* (■), and intermediates (△).

Key to the species

1a. Corolla pink or purplish, straight or slightly curved:
  2a. Corolla tube hairy beneath, often somewhat curved, ovary glabrous .... **1. A. nepalensis** (p. 12)
  2b. Corolla tube nearly glabrous beneath, straight, ovary pubescent .... **2. A. delavayi** (p. 12)
1b. Corolla white or cream, markedly curved .... **3. A. alba** (p. 14)

The species of *Acanthocalyx* are difficult to distinguish and Table 5 of diagnostic characters is provided to supplement the key.

Table 5 The species of *Acanthocalyx* compared.

	alba	*nepalensis*	*delavayi*
Calyx length (mm)	(5–) 6–7 (–12)	(9–) 11–12·5 (–14)	(7–) 10–14 (–15)
Calyx tube length (mm)	1–2·5	1–6·5	0·5–5·5 (–9)
Corolla curve	+	+(−)	0
Corolla hairs below	0–few	+	few
Corolla hairs above	+	+	few to +
Corolla colour	white (or cream)	pink	pink
Width of corolla tube (mm)	1·1–1·7	(1·4–) 1·8–2·1	(2–) 2·5–4
Ratio width/length	11·8–20	9–11	6·25–9 (–10)
Hairs inside involucel	0–very few on veins)	on top 0·5–1·5 mm	(0–) top 0·5–2 mm (–base)
Involucel teeth	(14–) 16 (–17)	9–15 (–16)	20–22 (–30)
Ovary hairs	+	0	+
Leaf shape	lanceolate (rarely linear lanceolate)	linear to narrowly lanceolate	(broadly) ovate – lanceolate to lanceolate

A number of specimens are difficult to allocate to the three species recognised. By far the largest number of these are found in gatherings from Yunnan and Sichuan, e.g. *McLaren's collectors* 309D, B73, *Potanin* on 29.6.1983, *Pratt* 45, *Rock* 17725, and most collections of this genus made by *Maire*. These gatherings appear to correspond with *A. delavayi*, except for the ovaries which are glabrous. A few are similar in most respects to *A. nepalensis*, but have pubescent ovaries (e.g. *Forrest* 7155) or two lines of hairs on the ovary (*Ludlow, Sherriff & Hicks* 16573). A few gatherings from Yunnan and Sichuan include plants with both pink and white flowers, e.g. *Pratt* 232; these are probably colour variants within the circumscription of *A. alba*. Certain collections from Xizang, e.g. *Soulie* 71 and *Dr King's collector* 8, probably have specimens of *A. alba* and *A. delavayi* mixed on the same sheet. A gathering from Xizang (*Morton*? 232) resembles *A. nepalensis* in most respects, but is recorded as having white flowers. This may be an albino form of *A. nepalensis* or may involve a label error. The large number of gatherings of intermediates and mixed collections suggest that different species often occur in close proximity. This could imply that hybrids are frequent, and/or that the group is still incompletely differentiated and that speciation is still continuing. However, until the situation can be properly analyseo using a range of experimental techniques on living plants, especially from areas where ranges overlap, we prefer to draw attention to the variation by recognising three species within *Acanthocalyx*, rather than to obscure the evidence by taking the easier option of recognising one taxon only at the species level.

Pai (1938) recognised four species, but this approach does not seem to be supported by our own observations. In his key characters used are the ciliate-spinose or densely ciliate nature of the lower leaves, but this seems to us to be completely variable in all species; the corolla lobes are said to be unequally lobed in *Morina betonicoides* (= *Acanthocalyx nepalensis*) and equally lobed in *Morina alba*. Both species seem to us to have more or less unequally lobed corollas, the upper two lobes being somewhat smaller than the lower three, and the two lateral lobes of the lower lip being rather narrower than the central lobe. *M. betonicoides* is said to have emarginate

corolla lobes, whilst *M. alba* has undulate-crenulate lobes, but this does not seem to be the case in the many specimens we have examined.

1. Acanthocalyx nepalensis (D. Don) M. Cannon, **comb. nov.**
Fig. 4.

Morina nepalensis D. Don, *Prod. Fl.Nepal.*: 161 (1825). Type: In Gossainthan Nepalensium, *Wallich* [presumed to be *Wallich* 424(BM; E; K – type collection).

Morina nana Wallich ex DC., *Prod.* **4**: 645 (1830). Type: Gossain Than, 1824, *Wallich* 424 (BM; E; K – type collection).

Morina betonicoides Benth., in *Ic. Pl.* **12**, t.1171 (1873). Type: Sikkim, 3400–3600 m, 12.7.1849, *Hooker* s.n. (K – holotype; BM – isotype).

Low perennial *herbs*, with short woody rhizome, covered with remains of old leaf bases. *Leaves* of sterile shoots entire, narrowly lanceolate or linear, glabrous or green above, glabrous and paler beneath, with midrib and 2–4 nearly parallel raised veins, with subspinose setae (rarely absent) on the margin, up to 20 cm. *Fertile shoots* erect, up to 35 cm (rarely to 50 cm), with leaves similar to those of the sterile shoots, except for the lowest pair, which are often small, nearly ovate or spathulate, membranous and spineless. *Upper stem leaves* usually shorter than those of the sterile shoots, opposite and decussate, with sheaths formed by the fusion of the two petioles; with 2 lines of hairs continued down the stem below the sheaths. The uppermost pair of leaves more spiny at the base, connate but not sheathing. *Bracts* ovate, spinose or ciliate, concave or folded. *Inflorescence* ± spherical, sometimes with one or two separated clusters below the primary head. *Involucel* cylindrical – campanulate, membranous at first becoming coriaceous in fruit, with short, often reflexed hairs inside, 0·5–1·5 mm below the rim, with 9–15 (or rarely more) setae, ± equal in length and with numerous hairs around the rim. *Calyx* ± cylindrical, mouth obliquely cut, usually with 2 lateral and 3 posterior teeth, the latter sometimes connate and with 1, 3 or more spines, the lateral teeth often spiny with 0–several setae. Calyx teeth (9–) 11–12·5 (–14) mm, the tube 4–6·5 mm with crisp hairs on the edge and sometimes also a few inside below the posterior teeth, rarely to the base. *Corolla* pink, or purplish, curved, the tube (1·4–) 1·8–2·1 mm wide, slightly swollen below the mouth with whitish spreading hairs all round. Lobes of the limb spreading, 5, subequal, the lower 3 rather broader than the upper 2, the middle lower lobe slightly broader than the 2 laterals. *Stamens* 4, all fertile, anthers introrse, subequal, scarcely emergent from the corolla tube, 2 inserted at the base of the swelling, the other 2 slightly lower. *Stigma* disc-shaped, scarcely papillose at the edge; style thread-like with a tuft of hairs just below the stigma. *Ovary* glabrous or rarely with a few long hairs, unilocular, with a pendulous ovule. *Achenes* rugose.

Distribution and ecology: A. nepalensis is the most commonly collected species in Nepal, Sikkim, Bhutan, and southern Xizang. There are fewer records to the east of Lhasa and in its immediate district, and it is thinly spread in Yunnan and Sichuan. In common with the majority of species in the Morinaceae, *A. nepalensis* is a plant of high altitudes and has been recorded at altitudes between 2500 and 4900 m, although the majority of records are in the ranges 3250–4750 m. It is recorded from a wide range of habitats, from rock ledges, alpine meadows, and dry slopes to woodland, and is often described as being abundant in the places where it occurs. The flowering season is mainly from June to July, but plants have been observed flowering as early as May and occasionally as late as in August, September, and October.

2. Acanthocalyx delavayi (Franchet) M. Cannon, **comb. nov.**

Morina delavayi Franchet in *Bull. Soc. bot. Fr.* **32**: 9 (1885). Type: In monte Hee Chan-men prope Lankong, 2.6.1884, *Delavay* 52 (P – holotype).

Morina bulleyana Forrest & Diels in *Notes R. bot. Gdn Edinb.* **5**: 208 (1912). Type: Chung Tien Plateau, 3400–3600 m, 1904, *Forrest* (E – lectotype). Mountains near Tali [Mt. Tsang Chan], 20.6.1884, *Delavay* 90 (P – isotype).

Barleria crotalaria A. Léveillé in *Reprium Spec. nov. Regni veg.* **12**: 285 (1913). – Lauener in *Notes R. bot.*

Fig. 4 *Acanthocalyx nepalensis* (D.Don) M. Cannon – the type species and a typical member of the genus *Acanthocalyx*.

Gdn. Edinb. **32**: 116 (1972). Type: Tong tchouan, Yunnan, 2700 m, *Maire* s.n. and Lou Pou, Yunnan, 3000 m, –.7.1912, *Maire* s.n. (E – syntypes).

Low perennial *herbs*, with short woody rhizome, covered with remains of old leaf bases. *Leaves* of sterile shoots entire, linear-lanceolate to ovate-lanceolate, slightly spiny or spineless, up to 16 × 3·2 cm, fusing to form pale coloured sheaths. *Fertile shoots* erect, 10–35 (–45) cm, lowest pair of leaves ovate, with the sheath equalling or exceeding the lamina. Lower leaves spiny or ± spineless. *Upper stem leaves* ovate-lanceolate to broadly ovate, deep green above, somewhat glaucous below, with 3–5 parallel veins, the petioles connate or sheathing, with 2 rows of white hairs continuing down the stem from the join. *Bracts* broadly ovate, the edges spiny, becoming more spiny towards the base. *Inflorescence* ± spherical, sometimes with a few flowers in the axils of the uppermost pairs of leaves. *Involucel* cylindrical-campanulate, fragile, papery at first, becoming thicker and larger in fruit, teeth ± uniform in length (16–) 20–30, hairy inside the top 0·5–1·5 mm, rarely to the base, very rarely without hairs. *Calyx* tube cylindrical-campanulate, (7·5) 9–13 (–15) mm, mouth obliquely cut, usually with 2 lateral and 3 posterior teeth, sometimes deeply cut, rarely quite entire, or the whole limb entire, terminating in a spine, the outside usually glabrous, rarely with a few hairs at the tip. *Corolla* magenta, red-crimson or purple, tube broad (2–) 2·5–4·5 mm, straight or ± curved below the region of the swelling, sparsely hairy to glabrous below and sparsely hairy to hairy above; lobes of the limb 3·5–6 mm. *Stamens* 4, all fertile, the anthers introrse, the lobes subequal, scarcely emergent from the corolla tube, 2 inserted at the base of the swelling, 2 just below. *Stigma* disc-shaped, somewhat papillose at the edge. Style thread-like, with a tuft of hairs just below the stigma. *Ovary* pubescent. *Achenes* rugose.

Observations: The syntypes of *Barleria crotalaria* A. Léveillé have glabrous ovaries and are somewhat intermediate between *A. delavayi* and *A. nepalensis*.

Distribution and ecology: A. delavayi occurs in western China, mainly in Yunnan and Sichuan, spreading northwards into Gansu and into the Xizang–Burma border region. It is a plant of high altitudes and has been collected between 2500 and 4000 m. Collectors record it from a variety of habitats, from dry stony ground to glacier meadows and the edges of pine woods. It appears to flower a little earlier than *A. nepalensis*, with the majority of records for May and June, with one single example from April and a few from July to October. However, the earlier flowering span may be merely a reflection of the somewhat lower altitudinal range.

3. **Acanthocalyx alba** (Hand.-Mazz.) M. Cannon, **comb. nov.**

Morina alba Hand.-Mazz. in *Sber. Akad. Wiss. Wien, Math.-Nat.* **62**: 68 (1925). Type: Likiang, Yulung Shan, N.W. Yunnan, 3500–4000 m, 1914, *Handel-Mazzetti* 3799 (?W – not seen).

Morina leucoblephara Hand.-Mazz. in *Sber. Akad. Wiss. Wien, Math.-Nat.* **62**: 68 (1925). Type: Yunnan, 1914, *Handel-Mazzetti* 3536 (?W – not seen).

Low perennial *herbs*, with short woody rhizome, covered with remains of old leaf bases. *Leaves* of the sterile shoots entire, linear-lanceolate, rarely slightly ovate-lanceolate, with short hairs on the margins, with or without spinose setae, lamina glabrous above and below. *Fertile shoots* erect, 20–35 (rarely to 45) cm, lowest pair of leaves ovate, thinly coriaceous, deeply sheathing, usually spineless, the sheaths as long as or longer than the lamina. *Upper stem leaves* entire, opposite and decussate, linear to linear-lanceolate, green above, somewhat glaucous below, 3–5 veined, the sheaths becoming shorter near the top of the stem, with 2 lines of white hairs below the fusion point of the petioles. Uppermost pair of leaves linear-lanceolate, slightly sheathing or connate. *Bracts* broadly ovate, spinose, very prickly at the base. *Inflorescence* ± spherical, sometimes with one extra whorl in the axils of the uppermost pair of leaves. *Involucel* cylindrical – campanulate, persistent and enlarging in fruit, teeth 14–16 (–17), glabrous or with a few hairs on the veins within the tube, with numerous hairs on the rim. *Calyx* tube cylindrical, 1–2·5 mm, mouth obliquely cut, limb (5–) 6–7 (–12) times as long as the tube, with 3 posterior teeth and 2 lateral, sometimes deeply cut and sometimes spiny. *Corolla* usually white, cream or yellowish, or shading to puce, the tube markedly curved, very hairy above, with few to 0 hairs below. Tube

12–20 × 1·1–1·7 mm, limb 5-lobed as in *A. nepalensis*. *Stamens* and stigma and style as in *A. nepalensis*. *Ovary* pubescent. *Achenes* pubescent, at least when young, often at maturity somewhat rugose.

Observations: Flower colour varies considerably. *Ludlow & Sherriff* 5017 records the colour as creamy-yellow, ranging to puce. This seems to correspond to a number of gatherings by several collectors who label their specimens as having white flowers, but in the gathering include individuals which appear to have much darker flowers than the average for the sample. The calyx is often flushed or almost completely coloured purple, both in the deep coloured specimens and in those with obviously white flowers.

In his review of Chinese *Morina* species, Pai (1938) includes *Morina leucoblephara* as a distinct species. Three gatherings recognised by him as *M. leucoblephara* have been seen by us (*Kingdon Ward* 5894, *Dungboo* 4634 and *Forrest* 28444) and appear to be identical in all respects to *Acanthocalyx alba* apart from their smaller stature. Handel-Mazzetti (1925) separates *Morina leucoblephara* from *M. alba* by size, the deep ventral fissure of the calyx and the 3 posterior teeth of the calyx, said to be totally connate in *M. leucoblephara*. Examination of the calyces of many plants of all *Acanthocalyx* species shows a great variety in the depth of the three posterior teeth; even in one plant there may be 3 or 5 deeply cut teeth, 3 closely connate teeth, or only one single tooth. There seems therefore to be no recognisable distribution pattern of this character in the populations. The depth of the ventral fissures in the *Forrest* specimen is 1·5 mm, which is within the range shown by many of the *A. alba* specimens measured by us.

Distribution and ecology: A. alba has a similar distribution to *A. delavayi*, occurring in Gansu, Sichuan, and Yunnan, but it does not extend so far to the west as that species. One specimen has been seen from northern Assam and one from eastern Xizang. *A. alba* is also a high altitude plant and has been collected from 2500–4250 m. It is noted as being abundant or extremely common by a number of collectors who describe it as a plant of varied habitats from open, dry pine forests to alpine meadows or even swamps. It flowers mainly between June and August, with occasional records from May and October.

II. CRYPTOTHLADIA (Bunge) M. Cannon, stat. nov.

Morina Section *Cryptothladia* Bunge, *Beit. Kentniss Flor. Russlands*: 321 (1852).
Type species: *Cryptothaldia parviflora* (Karelin & Kir.) M. Cannon

Plants perennial, often tufted, with a woody rhizome covered with the fibrous remains of previous year's leaves. *Leaves* linear to lanceolate, whorled or rarely paired, the margins often irregularly sinuate dentate and very spiny. *Inflorescence* verticillate, with several to many verticillasters, *flowers* sessile or short stalked; sometimes flowering at ground level and subsequently elongating to full height. *Bracts* free, connate at the base or fused for up to half of their length, forming shallow cups. *Involucel* tubular to campanulate, enlarging and becoming more rigid in fruit, with few to numerous teeth. *Calyx* cylindrical to campanulate, 2-lipped, each lip 2- (or rarely more) lobed. *Corolla* tubular, scarcely emergent from the calyx, 4- (or scarcely 5) lobed, rarely 2-lobed, the upper lip entire or scarcely 2-lobed, the lower lip often with 1 large central lobe and 2 much smaller lateral lobes; the lips scarcely separating and the flowers probably cleistogamous. *Fertile stamens* 2, inserted halfway down the corolla tube (one-third of the way in *C. chinensis*), anthers introrse, subequal. Pollen yellow or rarely purple–violet. *Sterile stamens* 2, inserted at or near the base of the corolla tube (⅓ of the way up in *C. chinensis*), sterile anther lobes equalling or exceeding the fertile anther lobes. *Nectaries* 2, at the base of the corolla tube, at or below the insertion of the sterile stamens. *Style* a little shorter than the corolla tube or just equalling it. *Ovary* unilocular, ovule solitary, pendulous. *Achenes* rugose, with obliquely truncate apex.

Six species of *Cryptothladia* are recognised by us: *C. parviflora* from the Tian Shan and Pamirs of south-east U.S.S.R. and its borders with China, *C. polyphylla* from south of the Himalayas, mainly in Nepal, but also occurring in Bhutan and south-eastern Xizang, *C. kokonorica* from north of the Himalayas in Xizang, *C. chinensis* from north-western China, *C. chlorantha*

Fig. 5 Distribution of *Cryptothladia* species: *C. chinensis* (●), *C. parviflora* (■), *C. kokonorica* (□), *C. chlorantha* (△), *C. polyphylla* (▲), and *C. ludlowii* (○).

occurring to the south of the range of *C. chinensis* in China, and *C. ludlowii* from Xizang, Assam, and Bhutan. See Fig. 5.

Key to the species

1a. Bracts connate, forming shallow cups throughout the inflorescence, teeth of the involucel much shorter than the tube (½ as long or less) … 5. **C. polyphylla** (p. 20)
1b. Bracts free (fused at the top of the inflorescence in *C. parviflora*), teeth of the involucel at least ⅔ as long as the tube: … 2
  2a. Leaves entire or nearly so: … 2
    3a. Bracts softly leafy with long acuminate tips, lower stem leaves not sheathing … 4. **C. chlorantha** (p. 19)
    3b. Bracts small, tri-lobed, or irregularly palmate-dentate, lower leaves deeply sheathing … 6. **C. ludlowii** (p. 22)
  2b. Leaves coarsely sinuate-dentate: … 4
    4a. Bracts connate in the upper whorls … 2. **C. parviflora** (p. 18)
    4b. Bracts not connate in upper whorls: … 5
      5. Staminodes ⅓ of way up corolla tube, calyx lobes 4, shallowly notched (up to 1 mm) … 1. **C. chinensis** (p. 17)
      5. Staminodes at base of corolla tube, calyx lobes 5 (rarely 4), deeply notched (up to 7 mm) … 3. **C. kokonorica** (p. 19)

1. **Cryptothladia chinensis** (Pai) M. Cannon, **comb. nov.**

Morina chinensis Pai in *Reprium Spec. nov. Regni veg.* **44**: 122 (1938). Type: Tao river basin in meadows of Maerhku, 2700–3000 m, 25.7.1925, *Rock* 12952 (E; K – lectotype).
Morina parviflora var. *chinensis* Batalin – referred to by Diels in *Notes R. bot. Gdn Edinb.* **5**: 208 (1912) – nom. nud.?

Herbs, with short rhizomes covered with old ± complete leaf bases. *Lower stem leaves* up to 10 (20) × 8 (12) cm, whorled or paired, linear in outline, irregularly sinuose, spinose-dentate; the teeth 2–3 fid with triangular lobules and apical spines and longer retrorse basal spines; the petioles fused to form loose sheaths, glabrous. *Upper stem leaves* similar but smaller, up to 6 in a whorl, free or scarcely connate, rarely with a very short sheath. *Flowering stems* up to 50 cm with 4 rows of hairs in upper parts, bearing several somewhat separated whorls of up to 20 flowers; the stem visible between at least the lower whorls. *Bracts* leafy, free, up to 25 mm, the lower part broadly ovate, markedly whitish and strongly net-veined; apices narrowly acuminate, spiny, greenish, the blade spinose-dentate with many longer and often retrorse spines at the base, hairy below and on the margin. *Involucel* narrowly campanulate to cylindrical, villous outside, tube 6–8 mm with 9–12 irregular spiny teeth (teeth not laminate at the base), often exceeding the calyx, 4–5 mm, 3 or 4 teeth often longer than the rest. *Calyx* 6–8 mm, cylindrical, with a 2-lobed limb, the lobes shortly bifid, the lobules slightly rounded or cuspidate, tube 3–4 mm with few hairs outside, villous and glandular within. *Corolla* cylindrical, the throat somewhat swollen, scarcely visible within the calyx lobes, limb more or less 2-lipped; lower lobe with 2 very small lateral lobes, upper lobe entire or rarely slightly divided; lips scarcely open at anthesis, pubescent and with sessile and stalked glands both within and without. *Fertile stamens* borne ⅔ of the way up the corolla tube, filaments short with a tuft of hairs just below the anthers. Anther lobes unequal, one up to 1·5 times as long as the other. *Sterile stamens* with short filaments and lobes as long as those of the fertile stamens, borne ⅓ of the way up the corolla tube, with 2 glandular nectaries at the base of the tube. *Style* about as long as the corolla, stigma disc-shaped. *Mature achenes* surrounded by the enlarged involucel and surmounted by the enlarged calyx; 3–4 × 2–2·5 mm, plano-convex, furrowed on the abaxial face, the top edge of the adaxial side rounded, smooth, not crenate.

Observations: The flowers are referred to as green on the labels of two specimens collected by *Rock*. This may refer to the colour of the calyx, as the corolla is scarcely noticeable within the more conspicuous calyx. Herbarium specimens appear to have whitish corollas.

A specimen collected at Sungpan hsein in Sichuan (*Fang* 4270) is probably best placed here. It obviously has affinities with a specimen for which the collector's name cannot be transliterated – 4484, which is similar in many respects to *C. parviflora*, but the shape of the calyx lobes is much more like those of *C. chinensis*, as are the achenes.

Distribution and ecology: C. chinensis is a high altitude plant; most collections are from localities at 3000–4000 m. It occurs in China in Xizang, Sichuan, Gansu, and Quinghai. Its habitats are variously noted as alpine meadows, mountain tops, and roadsides, flowering in June and July.

2. Cryptothladia parviflora (Karelin & Kir.) M. Cannon, **comb. nov.**

Morina parviflora Karelin & Kir. in *Bull. Soc. Nat. Moscou* **15**: 373 (1842). Type: Alpis Alatau ad sinistram ripam fl. Sarchan jacentis, *Karelin & Kirilow* (LE, not seen).

Herbs forming dense tufts, with sterile and fertile shoots. Rhizomes and lower parts of stems covered with fibrous sheathing bases from old leaves. *Lower stem leaves* and leaves of sterile shoots glabrous, linear with irregularly cut inciso-dentate spiny margins, up to 15 × 1 cm, in whorls of up to 6; petioles expanding abruptly into broad, fused bases. *Upper stem leaves* similar to those of sterile shoots, very shortly sheathing or barely connate, the uppermost whorl free; covered with spreading crisped hairs, with stalked and sessile glands on the upper surface, especially on the margins, the lower surface with fewer hairs and glands. *Flowering stems* up to 35 cm when mature, but very short at first and elongating during flowering; ridged and glabrous below, thickly covered with spreading hairs and glands above, square in section between the whorls of flowers, which are separate below but confluent above. *Bracts* up to 20 mm, free in the lower whorls, connate or fused above; the bases broadly ovate and conspicuously net-veined, the apices spiny, narrowly acuminate with long, narrowly-triangular spiny teeth densely covered with spreading hairs and glands on the upper surface, fewer below. *Involucel* cylindrical to campanulate, villous and with occasional stalked glands at anthesis, tube 5 mm, with 4–5 broad-based laminate teeth; 2 teeth subequal, *c.* 4 mm, much longer than the others and becoming rigid and spiny when mature. *Calyx* ± campanulate, conspicuously net-veined, villous and glandular, limb 2-lipped, each lip deeply bifid, lobes acute, sometimes spiny tipped. *Corolla* pinkish, cylindrical, the throat somewhat swollen, just emergent between the calyx lobes; with 4–5 fimbriate lobes, the upper lip emarginate or bilobed, the middle lobe of the lower lip ± equalling the lateral lobes. *Fertile stamens* 2, borne halfway up the corolla tube, anther lobes subequal, the shorter about ⅔ the length of the longer; filaments villous or with a tuft of spreading hairs. *Sterile stamens* borne just above the base of the corolla tube, less than ⅓ from the base; sterile anther lobes longer than the lobes of the fertile anthers, very narrow, somewhat pigmented. *Nectaries* lobed, at the base of the corolla, extending upwards as far as the base of the filaments of the sterile stamens. *Style* about as long as the corolla tube, stigma disc-shaped. *Mature achenes* 6 × 4 mm, rugose, shallowly furrowed and slightly convex on the abaxial face, the apex obliquely truncate, tapering to an acute point.

Observations: The fruiting specimen 4484 (collector's name not readable) on loan to us from Peking is in habit very much like *C. chinensis*, especially the specimen *Fang* 4270. However, the calyx lobes are acute, and the seed is much larger than that of typical *C. chinensis*. Pai considered it to be *Morina kokonorica* (= *Cryptothladia kokonorica*), but it has only four calyx lobes, and the plant is less spiny and the whorls of flowers are more separated than those of any specimen we have seen of *C. kokonorica*. It corresponds to *C. parviflora* in seed, habit, and the shape of the calyx lobes, and for these reasons we prefer to place it here. It has not been possible to translate the blurred chinese characters on the label. The superficial similarity of this specimen with *C. chinensis* may explain, in part, early references to *Morina chinensis* as a variety of *M. parviflora*, but apparently without valid publication.

Distribution and ecology: This species is known from Turkestan, from the borders of Kazakhstan with China (Dzungariau Ala-Tau), and from Kirgizia. It is stated to occur in the

alpine zone between 3000–4000 m, and to flower in June. Some collectors mention an unpleasant odour, reminiscent of some Labiateae.

3. Cryptothladia kokonorica (Hao) M. Cannon, **comb. nov.**

Morina kokonorica Hao in *Reprium Spec. nov. Regni veg.* **40**: 215 (1936). Type: Kokonor in den Wustentalern, 12.9.1930, *Hao* 1268 (not seen).

Herbs forming tufts from short woody rhizomes densely covered with the fibrous remains of old leaf bases. *Lower stem leaves* and leaves of sterile shoots paired or whorled, linear, coarsely and irregularly sinuate-dentate, with broadly triangular spinose lobes, and with broad petioles fused to form sheathing bases. *Upper stem leaves* similar, 5 or more whorled, up to 20 × 1 cm, free or scarcely connate, with numerous retrorse and erect spines at the leaf base, sessile. *Flowering stems* up to 40 cm, ridged and with 4 rows of hairs in the furrows above, terete and glabrous below, bearing up to 7 whorls of 16–20 flowers, the stem becoming visible at least between the lower whorls after flowering. *Bracts* 7–8 whorled, very spiny, often recurved and folded, becoming very stiff after flowering; coarsely toothed and with short stiff yellowish spines, broadly ovate at the base with a long acuminate spiny tip, glabrous. *Involucel* cylindrical-campanulate, tube 5–7 mm, often with 16–18 teeth, 2 (3–4) teeth much larger than the rest, often with several lateral spines or teeth, the longest as long as or exceeding the calyx. *Calyx* tube 4–5 mm with few hairs; limb 2-lobed, each of which is very deeply divided almost to the tube, to form (4) 5 (or rarely more) subequal lobes; the lobes ovate, acute to acuminate and often spiny tipped, greenish and leafy at anthesis, becoming dry and spiny with inrolled edges in fruit, and with a conspicuous tuft of hairs at the base of the tube. *Corolla* much shorter than the calyx, ± cylindrical with a few very short hairs on the outside; 4-lobed, the mouth scarcely opening. *Fertile stamens* borne halfway up the corolla tube, with short filaments, anthers subequal. *Sterile stamens* stalked, at the base of the corolla tube, with a nectary at the base of the filaments. *Style* nearly equalling corolla tube, stigma disc-shaped. *Mature achenes* rugose; convex on the adaxial face concave and deeply furrowed on the abaxial face; apex obliquely truncate, tapering to an acute point, 5·5 × 3–3·5 mm.

Observations: One gathering at BM (*Richardson* 124) consists of very small, low-growing plants, while others show individuals of varying heights. It seems probable that, in common with many other alpine plants, this species may begin flowering very close to the ground, after which the inflorescence elongates very rapidly to reach its maximum height, while flowers are still present in the upper part of the inflorescence. Several collectors describe the corolla colour as white.

Distribution and ecology: C. kokonorica is a high altitude species and collections seen range from 3750–4725 m. All specimens seen by us are from Xizang, but the type locality is from Kokonor in Quinghai. Its habitat has been recorded as stony ground and open hillsides, where it flowers in June and July.

4. Cryptothladia chlorantha (Diels) M. Cannon, **comb. nov.**

Morina chlorantha Diels in *Notes R. bot. Gdn Edinb.* **5**: 208 (1912). Type: East flank of Lichiang Range, Yunnan, 3000–3300 m, –.6.1906, *Forrest* 2482 (E – holotype; K – isotype).
Morina chlorantha var. *subintegra* Pax & K. Hoffm. ex Limpr. in *Beih. Repert. Spec. nov. Regni veg.* **12**: 497 (1922). Type: Ost. – Tibet, Ta Tsien lu, Sheto, steinige Halden des Tales vor dem Laniba, 4000 m, *Limprict* 1834; Ta tsien lu, Dawo, Gata, auf den Grassmatten des Passes Hai tse schan am Dshava, 4350 m, *Limprict* 1899 (not seen).

Herbs with stout rhizomes densely covered with remains of old leaf bases. Lower stem leaves ovate to obovate, 13–25 × 2·5–4 cm, somewhat toothed, especially near the base of the stem, with short spines around the edge; gradually tapering into petioles which become joined to form sheaths round the lower part of the stem, glabrous. *Upper stem leaves* entire, whorled, not connate; sessile, lanceolate or broadly lanceolate, sometimes with small spines. *Flowering stems*

35–50 cm, hairy all round above, glabrous and somewhat ridged below, bearing up to 7 somewhat separated whorls of 12–20 flowers, the stem often visible between the whorls. *Bracts* softly leafy in whorls of (3–) 4(–6), not connate, spreading and occasionally slightly recurved, broadly ovate, tapering gradually into a long-acuminate leafy tip or into a short spine, usually hairy on the margin and below. *Involucels* cylindrical campanulate, densely covered with hairs and sessile and stalked glands, with 11–14 spiny teeth, the bases only rarely laminate, slightly shorter than the tube, exceeding the corolla. *Calyx*, 8–11 mm, tube cylindrical 2·5–4 mm, with hairs and sessile and stalked glands more numerous within than without; with a 2-lobed limb, each lobe deeply notched, the lobules with rounded or spiny tips. *Corolla* hidden within the calyx lobes, white, cylindrical, with a somewhat swollen throat and with numerous hairs and sessile and stalked glands; 2-lipped, the lower lip with a large central lobe and 2 much smaller laterals, the upper lip ± entire or shallowly 2-lobed, the lobes shallowly crenate, the lips scarcely separating at anthesis. *Fertile stamens* borne halfway up the corolla tube, anther lobes very unequal, one sometimes twice the length of the other. *Sterile stamens* at the base of the tube, with short filaments, and lobes as long as those of the fertile stamens, and irregularly lobed *nectaries* at the base of the filaments of the sterile stamens. *Style* equalling corolla tube, stigma disc-shaped. *Mature achenes* surrounded by the enlarged involucels and surmounted by the enlarged calyx, 5 × 4 mm; subglobular, convex on the abaxial face, scarcely furrowed, the apex somewhat obliquely truncate, the top edge obtuse, entire or slightly crenate.

Distribution and ecology: C. chlorantha is distributed in Sichuan and Yunnan to the south of the range of *C. chinensis*. It occurs in alpine meadows, grassland, and on moist shady cliff ledges at altitudes between 3000 and 4425 m. It is in flower between May and July and is described as having a rank odour.

5. Cryptothladia polyphylla (Wallich ex DC.) M. Cannon, **comb. nov.**
Fig. 6.

Morina polyphylla Wallich ex DC., *Prod.* **4**: 644 (1830). Type: Nepal, Gossain Than, *Wallich* 425 (BM; K; LE – type collection).

Tufted *herbs*, the rhizome thickly covered with the fibrous remains of several previous years' leaf bases. *Lower stem leaves* whorled, with long narrow petioles fused to form sheaths at least ⅓ the length of the lamina, rarely equalling it, linear to linear-lanceolate, up to 40 × 1·5–2 (–3·5) cm, very coarsely incisodentate with 3–5 fid, broadly based triangular lobules with apical spines, glabrous or slightly pubescent. *Upper stem leaves* in whorls of (3–) 4–6, similar to the lower, but smaller, the bases much less deeply sheathing, rarely almost free. *Flowering stems* up to 45 cm, terete or slightly furrowed, with numerous spreading whitish hairs above, glabrous below, bearing several whorls of up to 16 sessile or short stalked flowers in a dense cylindrical spike, the lowest whorl rarely slightly separated from the rest. *Bracts* in whorls of (3–) 4–6, deeply connate at the base forming a pale cup-shaped structure with conspicuous green net-veining, the free tips of the bracts greenish, linear, with lateral spines tapering to a robust often yellowish spine. *Involucel* (6–) 9–13 mm, shorter than the corolla, but becoming larger and more rigid in fruit; cylindrical, toothed, usually pilose, rarely nearly glabrous; with many sessile and a few stalked glands; teeth 8–10 or fewer, 1–3 mm at anthesis, with a broad laminate base, tapering to a terminal bristle or spine, 1 or 2 longer than the rest. *Calyx* cylindrical to campanulate, 7–12 mm, tube 4–5 mm, usually very pilose and glandular within; limb expanded with 2 spreading white or lavender lobes, each deeply divided for at least half of its length, apices usually rounded, rarely, spiny tipped. *Corolla* just visible within the calyx lobes, pink or white, equalling the involucel, ± cylindrical with 4-lobed scarcely expanded limb, the lips scarcely opening, dentate-fibrillate at the edges. *Fertile stamens* 2, borne halfway up the corolla tube, anthers introrse, lobes subequal. Pollen purple violet. *Sterile stamens* at base of corolla tube, short-stalked, lobes long and tapering to a point, violet coloured, with a 3-lobed nectary at the base of each. *Style* equalling the corolla tube, stigma disc-shaped. Mature *achenes* 4·75–5·5 × 2·75–3 mm, plano-convex, obliquely truncate, the top edge of the adaxial face obtuse, crenate, scarcely furrowed on the

Fig. 6 *Cryptothladia polyphylla* (Wallich ex DC.) M. Cannon – a typical member of the genus *Cryptothladia*.

abaxial face, surrounded by the rigid expanded involucel and surmounted by the enlarged calyx.

Observations: The colour of the inflorescence has been variously described by collectors. Most describe the 'flowers' as red, bluish-red, pink, white, or pale violet. As the corolla is so small it is likely that it has been overlooked in a number of cases. In the specimens examined by us the young flowers are generally much paler in colour than the mature ones. It seems very probable that, as in the more familiar *Morina longifolia* and *M. persica*, the corolla changes colour from white to deep red as it matures. The calyx is described as pale green or white, the bracts being white or with pink margins. Many references to 'flower colour' probably refer to the conspicuous calyx rather than the corolla. The whole plant is recorded as having an unpleasant smell when bruised, and the leaves as being 'strongly aromatic'.

Distribution and ecology: C. polyphylla has been collected mainly from Nepal, with a few records from Bhutan, and two from the southernmost part of Xizang. It ranges in altitude from 2600 m to 4700 m. The flowering period appears to be mainly June and July, but it may extend from April to September. It is recorded as being abundant in some localities and appears to prefer a variety of mostly open habitats, such as grassy hill-slopes, alpine meadows and the like, although it has been collected from 'the forest floor' at 2600 m, which must be near the lower limit of its altitudinal range.

6. Cryptothladia ludlowii M. Cannon, **sp. nov.**
Fig. 7.

Ab aliis speciebus Cryptothladiae spica cylindrica et densa, bracteis trilobis differt.

Herbae caespitosae, caulibus floriferis anthesis initio brevibus tum celeriter per anthesis ad 47 cm altis extendentibus. Folia lanceolata, 4-verticillata, integra vel paucidentata; petioli generatim connati vaginas laxas facientes, eas caulis basi profundissimas eas super minores, petioli supremi tamen vix connati. Spika densiflora, cylindrica verticillis 20 ut minimum, in quoque 8–12 floribus. Bracteae parvae, imbricatae, saepe rubrae, verticillo infimo lanceolato superioribus trilobis, lobis spinoso-dentatis medio eis lateralibus maiore, apicibus acutis vel cuspidatis. Involucellum dentibus 4–8 (raro-12) uno quam ceteris saepe longiore latioreque, basi laterali, laminaribus anthesis initio mollibus et fragilibus, grandioribus rigidisque in maturitate. Limbus calycis bifidus, lobis breviter bifidis, lobulorum apicibus obtusis vel cuspidatis. Corolla parva, quadriloba, lobo posteriore fimbriato, anteriore integro super posteriorem arcuato. Stamina fecunda 2, medio corollae tubo inserta; staminodia imo inserta, lobis sterilis eos staminum fecundorum aequantibus vel superantibus. Achenia parva, 3 × 1·75 mm. subglobosa.

Type: Bhutan, Ju La, Mangbe Chu, 4250 m., *Ludlow, Sherriff & Hicks* 16903 (BM – holotypus; E – isotypus).

Herbs, the stem base and top part of the rhizome thickly covered with the fibres of old leaf bases. *Lower stem leaves* and leaves of the sterile shoots, in whorls of 4, lanceolate, entire or slightly toothed, with rather broad petioles fused together into loose sheaths, 5–7·5 × 10–12 mm, the margins with hairs and short spines, slightly glandular – pubescent above. *Upper stem leaves* similar to the lower, with broad based petioles forming shallower sheaths, the uppermost whorl often barely connate. *Flowering stems* very short at first, 2–3 cm, elongating rapidly up to 47 cm, terete or slightly grooved, densely covered with whitish, spreading, mostly retrose hairs. Inflorescence cylindrical, dense, up to 20 cm, often with 20 or more close packed whorls, 8–12 flowers in each whorl. *Bracts* small, leafy, regularly opposite and decussate, imbricate, lowest whorl rather similar to leaves but smaller; usually 3-lobed, lobes irregularly spinose-dentate, acute or cuspidate, the centre lobe larger than the laterals, often reddish or deeply coloured. *Involucel* campanulate – cylindrical, pilose, often with stalked or sessile glands; teeth 4–8 (–12), one often larger than the others, broad at the base, laminate, soft and fragile at anthesis, becoming larger and rigid in fruit. *Calyx* tube cylindrical-campanulate, 2·5–4 mm at anthesis; limb bifid, the lobes shallowly divided, lobules rounded to apiculate, glabrous without, with long white hairs and glands within. *Corolla* scarcely visible within lips of the calyx, ± cylindrical with a scarcely enlarged throat, glabrous without, 4-lobed, the posterior lobe ± fimbriate, the anterior lobe entire, markedly exceeding the posterior and arched over it, with strong erect hairs on the inner surface, with 2 very small lateral lobes; the whole closed or scarcely separating at

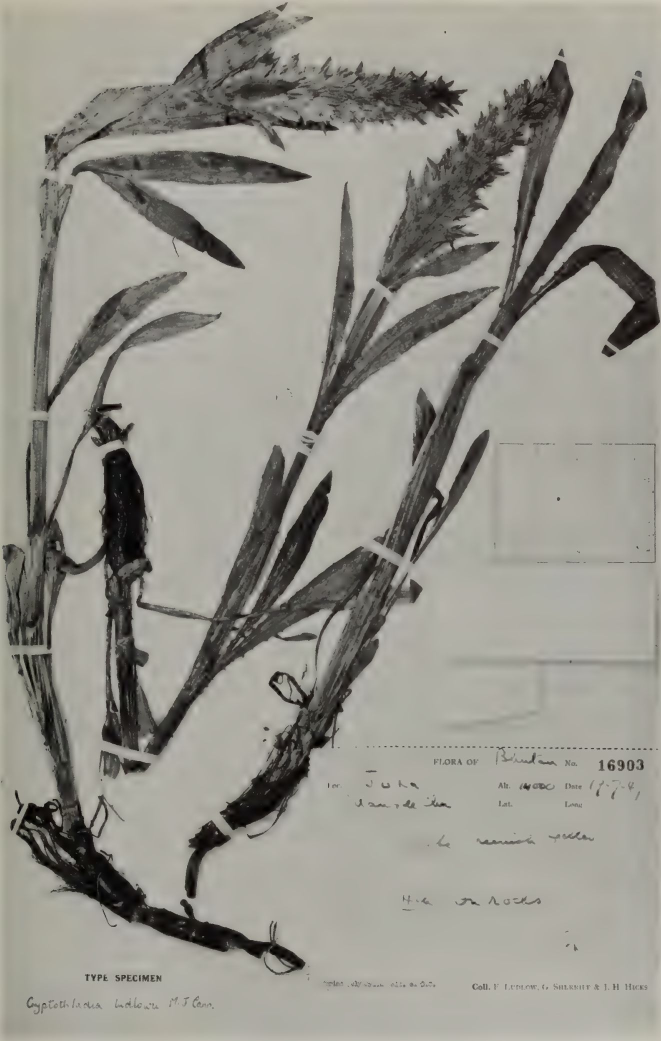

Fig. 7 Holotype specimen of *Cryptothladia ludlowii* M. Cannon.

anthesis. *Fertile stamens* 2, with short filaments, borne halfway down the corolla tube, anther lobes subequal, filaments with a tuft of hairs below the anthers. *Sterile stamens* 2, at the base of the corolla tube, shortly stalked, deeply pigmented, the sterile anther lobes as long as or longer than those of the fertile anthers, *nectaries* irregularly lobed, at the base of each sterile stamen. *Style* a little shorter than corolla tube, *stigma* disc-shaped. *Mature achenes* 3 × 1·75 mm, subglobular, with a shallow furrow on the abaxial face, apex slightly obliquely truncate, obtusely pointed, somewhat rugose.

Observations: We take particular pleasure in naming this species after the late Frank Ludlow, Honorary Associate of our Department, who was for many years an outstanding specialist on Himalayan plants and who, with George Sherriff, made many important collections in this region. A specimen from Bhutan *Gould* 486 (K) has a few long, narrow, spiny tipped bracts at the base of the inflorescence, becoming smaller and similar to those of typical *C. ludlowii* towards the apex. It closely resembles *C. ludlowii* in all other respects.

Distribution and ecology: C. ludlowii has been collected at altitudes of 3500–4250 m in Bhutan and its borders with Xizang and Assam. It is reported from a variety of habitats, such as amongst shrubs, on rocky hillsides, and on cliff ledges. Flowering is from May to September. The flowers are described as yellow, or yellowish green, but some obviously also have a red or violet pigment. The flowers are said to be sweet scented.

Specimens seen: Bhutan: Ju La, Mangbe Chu, 4250 m, 19.7.1949, *Ludlow, Sherriff & Hicks* 16903 (BM – holotype; E – isotype); Me La, south side, 4250 m, 29.5.1949, *Ludlow, Sherriff & Hicks* 20305 (BM); Kantanang, Tsampa, 3850 m, 4.6.1949 *Ludlow, Sherriff & Hicks* 19050 (BM; E); Ridge of Tashigong Kurted, 3700 m, 21.8.1915, *Cooper* 4525 (BM). Assam: Orka La, 4000–4250 m, 29.9.1938, *Kingdon-Ward* 14310 (BM). Xizang; Mago, 4000–4250 m, *Kingdon-Ward* 12383 (BM; K).

III. MORINA L.

Morina L., *Gen. Pl.* ed.5: 16 (1754).
Asaphes Sprengel, *Syst. Veg.* **4** (2): 222 (1827), nom. superfl. (Art. 63.1).
Morina Section *Diotocalyx* DC., *Prod.*: **4**: 644 (1830), excluding *M. polyphylla* Wallich ex DC.
Type species: *Morina persica* L.

Plants perennial with woody rhizomes, often covered with the remains of previous year's leaf bases. *Leaves* linear to oblong-lanceolate, spinose, incisodentate to almost entire, whorled or rarely paired, petioles often fusing to form loose sheaths. *Inflorescence* of several to many verticillasters, *flowers* sessile or short stalked. *Bracts* free, variable in size, usually spiny at least at the base. *Involucel* cylindrical to campanulate, with 8–16 teeth, 2 of which (usually opposite) are markedly longer than the rest. *Calyx* campanulate, with a 2-lipped limb, the lips somewhat to deeply 2 lobed, persisting at least until the fruit is mature. *Corolla* with a long narrow tube and spreading into a ± 2-lipped limb, the upper lip 2-lobed, the lower 3-lobed. *Fertile stamens* 2, adnate to the throat of the corolla; staminodes 2, cordate, within the corolla tube, *Nectary* 1, 3-lobed, anterior, at the base of the corolla tube. *Style* usually exceeding the stamens, stigma disc-like or slightly domed. *Ovary* unilocular, with a single pendulous ovule. *Achenes* rugose, somewhat or markedly obliquely truncate.

Four species of *Morina* are recognised by us: *M. kokanica* from the Tien Shan, *M. coulteriana* from the U.S.S.R., the western Himalayas, and Xizang, but absent from the eastern Himalayas, *M. persica* spreading from the Balkans through to the western Himalayas, and *M. longifolia* from the west and central Himalayas. See Fig. 8.

Key to the species

1a. Leaves simple .... **1. M. kokanica** (p. 26)
1b. Leaves coarsely dentate-serrate:
  2a. Corolla yellow, calyx lobes deeply notched .... **2. M. coulteriana** (p. 26)
  2b. Corolla white or pink, calyx lobes entire or shallowly notched:
    3a. Filaments 10 mm, teeth of involucel equalling or longer than the tube .... **3. M. persica** (p. 28)
    3b. Filaments 1–2 mm, teeth of involucel shorter than the tube .... **4. M. longifolia** (p. 30)

Fig. 8 Distribution of *Morina* species: *M. kokanica* (●), *M. coulteriana* (○), *M. persica* (▲), and *M. longifolia* (■).

1. **Morina kokanica** Regel in *Bull. Soc. Nat. Moscou* **40**: 14 (1867). Type: Kokan, Turkestan, 1866, *Sewerzow* s.n. (LE, not seen).

Robust *herbs* with rosettes of sterile leaves and flowering shoots. Rhizomes woody, the top often covered with the fibrous remains of petioles from previous years leaves. *Leaves of sterile shoots* and lowest stem leaves glabrous, oblong lanceolate 25–35 × 2–4·5 cm, entire or rarely with occasional small teeth or prickles, midrib prominent, sometimes elongated to form a small spine; petioles free or fused to form short sheaths of 2–4 mm. Upper stem leaves similar to lower, opposite or 3–4 whorled, petioles free. *Flowering stems* erect, somewhat square in section, grooved and ridged, glabrous below, with well-separated whorls of numerous short-stalked flowers; sometimes with short flowering shoots in the axils of the upper leaves. *Bracts* often rather leaf-like in the lowest whorl, broadly ovate with an acuminate tip tapering into a spine, the margin with a few rigid spines, somewhat villous below, the bases scarcely overlapping each other. *Involucel* cylindrical, the tube at anthesis 5–6 × 3–4·5 mm, becoming twice as long or more at maturity, villous, with 12–16 teeth, two longer than the others, the longest shorter than the tube. *Calyx* cylindrical-campanulate, 5–6 × 3–4·5 mm, often densely glandular hairy, limb 10–16 mm, 2–3 times as long as the tube at anthesis, lobes shallowly bifid, tips obtuse. *Corolla* pale purple or pink with a darker area on the lower lip, the tube long and narrow, 35–45 × 1–3 mm, the throat somewhat swollen, limb deeply cut, the lobes 10–15 × 6–7 mm, densely glandular hairy on the tube, somewhat less so on the interior and exterior of the limb. *Fertile stamens* 2, filaments about 7 mm, with a tuft of hairs just below the anthers, anther lobes subequal, the longer 2 mm, the shorter 1·7 mm. *Staminodes* 2, minute, ± heart shaped, inserted 2–3 mm below the mouth of the corolla on the anterior side. *Nectary* 1, 3-lobed, anterior at the base of the corolla tube. *Style* slightly exceeding the stamens, stigma disc-shaped. *Achenes* rugose, ± plano-convex with prominent diagonal veins, the apex obliquely truncate, somewhat fluted.

Distribution and ecology: M. kokanica is apparently confined to the Tien Shan and Pamir-Alai regions of Soviet central Asia at altitudes of 1600–3000 m. The recorded flowering period is June to August.

2. **Morina coulteriana** Royle, *Illus. Bot. Himal.*: 245 (1835). Type: Kunawar, *Royle* s.n. (LIV – holotype).
Fig. 9.

Morina breviflora Edgew. in *Trans. Linn. Soc. Lond.* **20**: 62 (1846). Type: Pharkia near the Niti Pass in Kumaon, *Edgeworth* 259 (K – holotype).
Morina lehmanniana Bunge, *Beit. Kenntniss Flor. Russlands*: 321 (1852). Type: In den Alpen des Karatau, 12.9.1841, *Lehmann* s.n. (P, not seen).

Robust *herbs* with rosettes of sterile leaves and flowering stems. Rhizomes woody, often covered with old leaf bases. *Leaves of sterile shoots* and lower stem leaves 20–25 × 2·5 cm, glabrous, pinnatilobate, with spiny simple or compound teeth, petioles soft, fusing to form deep sheaths of 8–15 mm. Upper stem leaves similar but smaller, in whorls of 3–4 (–5), free or with short sheaths up to 3 mm or rarely more. *Flowering stems* erect, up to 1·25 m, stems ridged and glabrous below, square sectioned, villous and often deeply purple – pigmented above. Flowers in up to 7 whorls, the upper 2–5 whorls confluent, with 2–4 separated whorls below, flowers 50 or more per whorl, sessile in the outer part of the whorl, shortly petiolate (up to 2 mm) nearest to the stem. *Bracts* broadly ovate with long acuminate tips, very spiny, often villous especially near the stem, conspicuously net veined. *Involucel* ± cylindrical, villous, 4–9 × 2·5–4 mm, with 9–12 teeth, 2 much longer than the others, the longest at least equalling or up to nearly twice as long as the tube at anthesis. *Calyx* glabrous to villous, with a large tuft of hairs at the base, glabrous or very shortly pubescent within, cylindrical-campanulate, 3–6·5 × 2–4 mm, usually more than twice as long as wide at anthesis. Limb 2-lipped, villous, pubescent or glabrous without, glabrous within; lips deeply bifid for 2–5 mm, apices acute or apiculate, with a short but prominent vein within, often extended beyond the tip to form a spine. Mature calyx often equalling the corolla

Fig. 9 *Morina coulteriana* Royle – a typical member of the genus *Morina*.

tube. *Corolla* yellow, tube villous, without glandular hairs or with very few, long and narrow, 25–30 × 1–2 mm, throat somewhat expanded, limb 2-lipped, the upper lip 2-lobed, the lower 3-lobed, median lobe of the lower lip 5·5–10 × 3·5–6 mm. *Fertile stamens* 2, the filaments 2–3 mm at anthesis, inserted just within the corolla tube, with a tuft of long hairs below the anthers. Anther lobes unequal, one ⅔ the length of the other. *Staminodes* minute, heart shaped, inserted 2·5–4·5 mm below the mouth of the corolla, below the anterior lip. *Nectary* 1, 3-lobed, anterior at the base of the corolla tube. *Style* slightly exceeding the stamens, stigma disc-shaped. *Achenes* with convex adaxial face, transversely rugose, abaxial face rugose, with very deep longitudinal furrows; apex somewhat obliquely truncate, with conspicuously undulate margins.

Observations: Plants from Xizang have slightly smaller corollas than those from the western end of the distribution range, the median lobe of the anterior lip of the corolla measuring 5·5–7 × 3–4 mm, the width of the lateral lobes 2·5–3 mm, and the other lobes being correspondingly smaller than those of plants from further west. The length of the filaments also differ slightly, those of the Tibetan plants being slightly longer (2·75–3·5 mm) than those of their western counterparts (2–2·5 mm). A collection from Kashmir – *Ludlow & Sherriff* 9123 from the Macchel Sapphire Mines, Kishtawar, has flowers similar in size to the Tibetan plants, but careful measurements of many individuals from both east and west show no other significant differences. No formal recognition of this variation therefore seems appropriate. A gathering from Kashmir – *Robson* 2013 consists of plants with rather narrow, almost spineless leaves, but corresponds to typical *M. coulteriana* in all other respects.

The type of *M. lehmanniana* has not been seen by us. It was described by Bobrov (1957) as from the upper Zaravshan, near the village of Fon and as being in the Paris Herbarium. A specimen from the Bunge herbarium from Zaravshan has been seen; it is identical in all respects with *M. coulteriana*. Specimens from this area tend to be conspicuously white-hairy above, but a number of Afghan and Kashmir plants also share this character.

Distribution and ecology: M. coulteriana occurs in the western Himalayas, the Hindu Kush, and central Afghanistan, and as far north as the Tien Shan, and also in eastern Xizang, but without intermediate stations in Nepal, Sikkim, or Bhutan. This kind of disjunct distribution has been referred to by several authors, e.g. Stainton (1972), Meusel (1971), and Kingdon-Ward (1936), and is shown by a large number of genera. In many cases such plants have been described as closely related vicarious species. In this instance, there seems to be no justification in recognising the Tibetan plants as a distinct taxon. It is improbable that the species occurs in intermediate Nepalese localities, as other similar species have been collected there and it seems likely that a yellow-flowered *Morina* would have readily attracted the attention of the many experienced collectors that have now travelled extensively in that country. There seems to be no obvious reason for its absence from the central Himalayas, since it is a species of open habitats and has been recorded from many substrates and habitats. It seems possible that the wetter monsoon conditions of the eastern Himalayas do not suit it so well, although it has been recorded as growing in a number of wet situations – streamside, wet sand, and moist pastures, and many arid habitats are available in Nepal behind the main range. It is a plant of high altitudes, rarely recorded below 2500 m and attaining 4000 m in Nepal; most records are found between 3000–3500 m. *Aitchison* 746 from the Kurram Valley in Afghanistan has the fieldnote 'at and above 11000–13000 ft (3300–4000 m) this yellow flowered species quite replaces *M. persica*.' It has been reported from a wide range of habitats, both sheltered and exposed, possibly favouring dry conditions but also occurring in damp areas. The flowering period is mainly from June to August, with some plants still in flower in September.

3. **Morina persica** L., *Sp. Pl.* 1st ed.: 28 (1753). Type: Habitat in Persia ad Hispaham, Herb. Linn. 44/1 (LINN, isolated corolla only).

Morina orientalis Miller, *Gard. Dict.* 8th ed. (1768), nom. superfl. (Art. 63.1).
Morina verticillata Moench, *Meth. Suppl.*: 186 (1802), nom. superfl. (Art 63.1).
Morina wallichiana Royle, *Illus. Bot. Himal.*: 245, t.55 (1835). Type: Mussooree, *Royle* (LIV – holotype).

Morina aucheri Jaub. & Spach, *Illustr.* **5**: t.429 (1854). Type: Persia Australis, *Aucher Eloy* (BM; K) & *Kotschy* ?549 and ?2190 (BM; K; LE – syntypes).

Morina graeca Jaub. & Spach, *Illustr.* **5**: t.429 (1854). Type: Greece, Sibthorp s.n.; *Bory de St Vincent* (not seen); *Heldreich* s.n. (E; K; LE – syntypes).

Morina tournefortii Jaub. & Spach, *Illustr.* **5**: t.429 (1854). Type: Armenia circa urbem Erzeroum, *Tournefort* s.n.; Asie minore, *Aucher-Eloy* s.n.; *Jaubert* s.n.; and *Pinard* s.n. (syntypes, not seen).

Morina subinermis Boiss., *Diagn.* II, **6**: 94 (1859). Type: Turkey, in Bithynia. *Duparquet* (not seen).

Morina persica subsp. *turcica* Hal. in *Oester. Bot. Zeit.* **41**: 409 (1891). Type: Macedonia prope Demirkapu, 19.8.1889, *Farmanek* s.n. and Tekir Dagh, in saxis promontorii Hodja Burnu, inter pago Panidos et Kumbaos litoris Propontidis, 2.7.1890, *Degen* s.n. (not seen).

Morina turcica Degen & Hal. ex Čelak. in *Bot. Jb.* **17**: 396 (1893), nom. nud. (Art. 32.1).

Morina spectabilis Gontsch. nom. nud. (Art. 32.1) ?in Herb. LE, cited by Komorov in *Fl. U.R.S.S.* **24**: 8 (1957).

Robust *herbs* often forming large clumps of sterile rosettes and flowering shoots. Rhizome woody, the top often covered with the fibrous remains of old leaves. *Leaves of sterile shoots* and lower stem leaves up to 25 × 2 cm, 3–4 per whorl, glabrous, ± linear, with fairly regular 2–5 lobed, narrowly triangular teeth, petioles broad based, connate, forming short sheaths of 2–3 mm. Upper stem leaves smaller, similar to the lower leaves, but petioles scarcely connate or free, 3–4 leaves per whorl. *Flowering stems* erect, up to 1·25 m. Stems densely villous and glandular, square stemmed above, becoming terete or somewhat ridged and with fewer hairs below. Flowers sessile or shortly-stalked, up to 50 or even more per whorl, in up to 8 (rarely more) whorls, sometimes with small flowering shoots in the axils of the upper leaves. Whorls usually well separated from one another, the uppermost sometimes confluent. *Bracts* very variable, usually twice as long as the calyx whorls, linear with long acuminate tips, gradually tapering into a long spine, or broadly ovate with a shortly spiny acute apex; almost glabrous to densely villous and glandular, spiny, sinuate-dentate and similar to the leaves to almost entire with few spines. Bracts of lower whorls free or slightly overlapping at the base, upper bracts free or very rarely connate. *Involucel* cylindrical campanulate, tube 7–10 × 3·5–5 mm, densely villous and with sessile glands and stalked glandular hairs to almost glabrous; teeth (8–) 10–14 (–16) of varying lengths, two usually much longer than the others, the longest much exceeding the tube or rarely equalling it, often up to 14 mm or more at anthesis, the 2 longest teeth broad based, laminate at anthesis, becoming inrolled and rigid at maturity. *Calyx* ± glabrous, or very shortly pubescent outside, with a tuft of long white hairs at the base, tube broad, often as wide as deep, 3–5 mm long, lips often much longer than the tube, apex obtuse, nearly truncate or very shallowly emarginate. *Corolla* white, becoming pink or red, the tube very long and narrow 35–45 mm, with or without simple and glandular hairs, the throat somewhat swollen; limb ± 2-lipped, the upper 2-lobed, the lower 3-lobed, lobes 12 × 6 mm or more. *Fertile stamens* 2, filaments 9 mm or more, inserted at the top of the tube; anther lobes subequal. *Staminodes* minute, heart shaped, inserted 4–5 mm below the mouth of the corolla, below the anterior lip. *Nectary* 1, 3-lobed, anterior at the base of the corolla tube, *Style* longer than the stamens, stigma disc-shaped. *Achenes* rugose, adaxial face, ± convex, somewhat longitudinally furrowed, abaxial face furrowed, transversely rugose, apex obliquely truncate.

Observations: The protologue in the original Linnæan description refers directly with an unmodified descriptive phrase to *Hortus Cliffortianus*. For this reason, a specimen in that collection would be a preferred choice for typification. However, since there is no *Morina* specimen in that herbarium, the fragmentary material in the Linnæan herbarium (corolla only) has been adopted as the best available alternative. The geography of the group and morphology of the corolla leave little doubt as to the validity of the typification.

Plants from the Mussoorie area of India were described by Royle as *M. wallichiana*, nearly allied to *M. persica*, but having spiny lobed leaves, the upper stem and corolla softly villous, and the calyx lobes entire or shortly emarginate. The type specimen is a plant with rather ovate bracts and few spines, and corresponds closely with a number of specimens seen by us from this area. These tend to be greyer in colour and with fewer spines on the margins of the bracts than typical *M. persica*. However, a range of bract variation occurs in *M. persica* from broadly ovate

to narrowly linear, with apices acute and shortly spined to narrowly acuminate and long spined, the plants from Mussoorie being at one end of the variation range and not meriting the retention of specific rank. Although many plants of this kind appear to occur in the Mussoorie area, similar individuals have also been seen throughout the remainder of the range of *M. persica*, from Afghanistan to Bulgaria. We do not, therefore, consider Royle's taxon to merit retention as a geographically based subspecies, and it is best considered as a rather extreme form within the overall variation pattern of *M. persica*. An interesting specimen collected in the Muree Hills of Pakistan (*Prescott Decie* s.n. 1915) is probably another extreme variant of *M. persica*, one specimen on the sheet having leaves that are almost entire or with very small teeth. The bracts are broadly lanceolate, entire or with a few simple teeth, the upper whorls are connate, forming a small funnel-shaped sheath. The corollas have a dark coloured blotch on the lower lip; the colour appears to be yellow, but there is no field note in support of this conjecture. The specific rank of *M. subinermis* is maintained by Matthews (1972). It is known only from the type, which we have not seen. It should probably be regarded as a synonym of *M. persica*, as the description is in accord with the variant described above (*Prescott Decie* s.n., 1915).

Distribution and ecology: M. persica is distributed across western Asia and reaches south-eastern Europe in Bulgaria, Romania, and Greece. It is widespread in Turkey, Iran, Israel, and Lebanon. It is common in Afghanistan, Kashmir, and Pakistan, where its range overlaps those of *M. longifolia* and *M. coulteriana*. This species occurs at lower altitudes than any other members of the Morinaceae, being found at altitudes below 500 m in Turkey, although it has been recorded from 3730 m in Afghanistan. It is a species of dry rocky places, steppe, and semi-desert and is often found as a roadside weed. It appears to tolerate both acid and alkaline soils, and is noted as growing on sandstone, dry granite, limestone, chalk, etc. Flowering normally seems to occur from May to August, but it has been also reported in April, September, and October. According to the notes with *Chick* 144, the peasants of Iran are said to eat the seeds and describe them as being like rice.

4. Morina longifolia Wallich ex DC., *Prod.* **4**: 644 (1830). Type: Gossain Than, Nepal, *Wallich* 426 (BM; K; E – type collection).

Morina elegans Fischer & Avé-Lall. in *Index Seminum Hort. bot. imp. Petropol.* **8**: 67 (1841). Type: In alpibus Himalaya, nota apud nos e seminibus a Cel. Candolleis acceptis (not seen).

Robust *herbs* forming clumps of sterile rosettes and flowering shoots. Rhizomes woody, the top often covered with the fibrous remains of previous year's leaves. *Leaves of sterile shoots* and lower stem leaves glabrous, linear to linear-lanceolate, up to 40 × 4 cm, with fairly regularly coarsely cut 4–5 lobed teeth, spiny tipped, the petioles fused to form deep sheaths of 25–45 mm. Upper stem leaves similar, usually 3 per whorl, smaller, sheaths 8 mm or less, or petioles barely connate. *Flowering stems* erect, up to 90 cm, somewhat square in transverse section and pubescent to villous above, glabrous and slightly ridged to terete below. Flowers in (4–) 7–9 (–11) whorls, some shortly pedicillate others sessile; the upper whorls confluent, becoming more separated as the inflorescence matures. *Bracts* broadly ovate to orbicular with an acute spiny tip, margins often with numerous short spiny teeth, villous below and on the margins, often with few hairs and glossy outer surface, the bases markedly overlapping. *Involucel* ± cylindrical, glandular-hairy, sometimes densely so, 7–10 × 2·5–4 mm with (5–) 8–10 (–13) teeth, 2 much exceeding the others, glabrous tipped and with adpressed hairs below, not or scarcely laminate, shorter than or rarely equalling the calyx tube at anthesis. *Calyx* ± glabrous or with short adpressed hairs on the lips, lobes shallowly bifid, apices of the lobules rounded or rarely slightly apiculate; tube 4·5–6 × 2·5–4 mm at anthesis *Corolla* white, becoming pink then deep red, the tube with many glandular and a few simple hairs without, 20–30 × 1–2 mm, throat somewhat expanded, lobes of the lower limb somewhat spreading, upper lip ± patent, median lobe of lower lip 7 × 3 mm. *Fertile stamens* 2, filaments 1–2 (–3) mm, with a tuft of hairs below the anthers, inserted just inside the throat of the corolla. Anther lobes unequal, the shorter sometimes ⅔ or less the length of the longer. *Staminodes* minute, inserted 2–3·5 mm below the

mouth of the corolla, under the anterior lip. *Nectary* 1, 3-lobed, anterior at the base of the corolla tube. *Style* a little longer than the stamens, stigma disc-shaped or somewhat domed. *Achenes* with abaxial face rugose with diagonal veins, adaxial face with deep furrow and prominent longitudinal veins; apex somewhat obliquely truncate and crenulate.

Observations: The specimens of *M. longifolia* examined by us showed relatively little variation. Size differences occur, notably a specimen from Bhutan, *Ludlow, Sherriff & Hicks* 1958, which is particularly robust, with leaves of up to 50 × 8 cm and very large leafy bracts.

Distribution and ecology: M. longifolia is mainly distributed in the Himalayas and Hindu Kush, and is the only member of the genus to be found in Nepal and Bhutan. In the Punjab, western Kashmir, and Pakistan its range overlaps those of *M. persica* and *M. coulteriana*. It is a plant of high altitudes and we have seen no specimens from below 2000 m, the highest record, a specimen from Nepal, was reported from 4250 m, while most specimens are collected from between 3000 and 3750 m. It occurs in a wide range of wet and dry habitats, often on grassy slopes or under shrubs. The flowering period is from June to September, sometimes extending into October. This species is quite widely cultivated in Britain by discerning plantsmen, and in the authors' garden in Surrey it flowers in June and July, with occasional small basal shoots flowering in October. The flowering sequence has been described by Kerner (1881). He observes that the white flowers open at dusk, and are pollinated by night-flying moths, after which they turn red and bend away from the rest of the flowers in the whorl in the course of a few hours. This does not correspond to our observations as, in our plants, the flowers open in the daytime, becoming pink by the following day, and do not turn red until the third day. Examination of unopened flowers showed pollen already adhering to the stigmas, perhaps indicating that cleistogamy may occur in this genus, paralleling the probable cleistogamy in *Cryptothladia*.

Specimens examined

In the following enumeration all the specimens examined during the course of this study have been listed, primarily by genera and species, and secondarily by collectors and specimen numbers. The location of all specimens is shown using the standard international abbreviations for the institutions concerned; a list of these will be found under the acknowledgements. Since the number of taxa is not very large, it should be reasonably convenient for curators to use the list as a means of checking identifications of further duplicates of the listed gatherings.

I.1. *Acanthocalyx nepalensis* (D.Don) M. Cannon
Beer, Lancaster & Morris 9419 BM. *Bor & Kirat Ram* 20444 K. *Bowes Lyon* 2058 BM; 3264 BM; 15126 BM; *Bowes Lyon* s.n. BM. *Cave* 53 E. *Chu* 2785 E. *Clarke* 12913 K. *Cooper* 62 BM, E; 99 BM, E; 258 BM, E; 1585 BM; 1699 BM, E; 2170 BM; 2533 BM; 2935 BM. *Dobremez* 337 BM; 380 BM. *Dungboo* 55 E; 8539 LE. *Einarsson, Skarby & Wetterhall* 606 BM; 892 BM. *Gamble* 9520 K. *Gould* 904 K. *Grikley* s.n. LE. *Grierson & Long* 2592 E; 2669 E. *Hanbury-Tracy* 28 BM; *Hara, Kanai, Mutara, Togashi & Tuyama* 2863 K. *Hingston* 181 K; 386 K. *Hobson* in 1897 K. *Hooker* in 1849 K. *King's collector* 647 K; in 1888 LE; in 1886 LE. *Kingdon-Ward* 11808 BM; 19582 BM; E; s.n. K. *Lall Dhwoj* 167 BM, E. *Lepcha* 15 E. *Lobbichler* s.n. BM. *Ludlow & Sherriff* 170 BM; 422 BM; 1792 BM; 8780 BM; 8799 BM, E; 9756 BM, E; 11022 BM, E. *Ludlow, Sherriff & Elliott* 15184 BM, E; 15677 BM. *Ludlow, Sherriff & Hicks* 16379 BM, E; 19088 BM; 20293 BM. *Ludlow, Sherriff & Taylor* 4700 BM, E; 5518 BM, E. *McCosh* 322 BM. *McLaren's collectors* AC140 E. *Maire* 49 E. *Morton* 232 K. *Polunin* 329 BM; 627 BM; 1151 BM. *Polunin, Sykes & Williams* 78 BM; 1546 BM; 2329 BM; 4536 BM. *Pratt* 45 BM. *Ramesh Bedi* 366 K; 1066 K; s.n. K. *Ribu & Rhomon* 5270 K. *Richardson* 245 BM. *Rohmoo Lepcha* 787 E. *Schilling* 394 K; 995 K. *Sharma* E 416 BM. *Shreltow* 5140 BM. *Shrestha & Joshi* 220 BM. *Smith* 120 BM. *Spencer-Chapman* 418 K; 652K. *Stainton* 875 BM, E; 557 BM, E. *Stainton, Sykes & Williams* 3192 BM; 3237 BM; 4652 BM. *Waddell* 18 BM. *Wager* 285 K. *Williams* 792 BM. *Wallich* 424 K. *Younghusband* s.n. K. *Yu* 19845 E; 19730 E. *Zimmerman* 694 BM.

I.2. *Acanthocalyx delavayi* (Franchet) M. Cannon
Delavay 52 (298) P; 90 P; in 1885 P; in 1887 K. *Forrest* 393 E; 4653 E; 5638 BM, E, K; 5670 BM, E, K; 6104 BM, E, K. *Handel-Mazzetti* 2989 E; 9754 E. *Kingdon-Ward* 9632 BM. *McLaren's collectors* L2A

BM, E, K; N66 BM, E, K. *Manberg* s.n. K. *Monbeig* 62 E, K; 140 E; s.n. K. *Potanin* s.n. K. *Rock* 3422 E; 3781 E; 16260 E, K; 18098 E; 23835 BM, E, K; 23942 E; 24610 BM, E, K; 24692 BM, E, K; 24980 BM, E, K. *Schneider* 1494 E, K. *Sino–British Expedition* 737 K. *Soulie* 71 pars K; 975 K. *Tu* 4493 PE. *Wilson* 3781 pars BM, K. *Yü* 22152 E; 22750 E.

I.3. *Acanthocalyx alba* (Hand.-Mazz.) M. Cannon
Cunningham 471 E. *Delavay* 91 K, P; in 1886 P, K. *Dungboo* 6434 K; s.n. K. *Fang* 4008 E, K, PE; 6036 E, K, PE. *Farrer & Purdom* 215 E. *Forrest* 5832 BM, E, K; 2685 BM, E, K; 28444 BM, E; 28826 BM, E. *Gould* 2133 K. *Hanbury-Tracy* 51 BM. *King's collector* 547 K. *Kingdon-Ward* 5894 E, K; 7065 K. *Ludlow & Sherriff* 8833 BM, E. *Ludlow, Sherriff & Elliott* 14077 BM, E; 15370 BM, E. *Ludlow, Sherriff & Taylor* 5017 BM; 6180 BM, E. *McLaren's collectors* AC163 E; L50A BM, E, K; N104 BM, E. *Maire* 2 BM. *Potanin* in 1885 K; in 1893 K. *Pratt* 202 BM; 232 pars BM, E, K; 696 K. *Purdom* 872 K. *Rock* 4636 E; 5564 BM; 12617 E, K; 13119 BM; 14611 E; 16404 E; 17406 E, K; 24113 BM, E, K; 24885 pars BM, E, K. *Schneider* 3426 K; 3639 K; 3680 K. *Soulie* 71 pars K; 577 K. *Wilson* 3781 pars BM, K. *Yu* 8671 BM; 13625 BM, E; 15252 BM, E.

Intermediates between *A. nepalensis* and *A. delavayi*
Chu 2785 BM. *Forrest* 7155 E; 14022 E; 27124 E. *Gould* 511 K. *Kingdon-Ward* 325 K. *Lowndes* L1125 K. *Ludlow, Sherriff & Elliott* 13894 BM. *Ludlow, Sherriff & Hicks* 16573 BM; 19017 BM. *McLaren's collectors* 309D BM, E, K; B73 E, K. *Maire* 49 E; 66 E; 69 E; 82 E; 86 E; 128 BM, E; 715 E; 729 E. *Potanin* s.n. K. *Pratt* 45 BM, K. *Rock* 17725 BM, E; 17823 E; 24072 BM, E, K.

Intermediate between *A. nepalensis* & *A. alba*
Gregory B99 K. *King's collector* 8 K. *Pratt* 232 BM, E, K.

II.1. *Cryptothladia chinensis* (Pai) M. Cannon
Ching 539 E. Fang 4270 E, K, PE. *Hao* 1002 PE. *Licent* 4548 BM, K. *Potanin* in 1885 K; s.n. K. *Przewalsky* s.n. K. *Rock* 12556 BM, LE; 12952 E, K. *? collector* 1792 PE; 6129 PE.

II.2. *Cryptothladia parviflora* (Karelin & Kir.) M. Cannon
Gubanov 915 MW. *Gukun* s.n. BM. *Karelin & Kirilov* s.n. BM, K. *Konsevyanova* s.n. MW; *Regel* 21798 BM, E, K, LE; s.n. K, LE. *?collector* 4484 PE.

II.3. *Cryptothladia kokonorica* (Hao) M. Cannon
Gould 2217 K. *Ludlow & Sherriff* 8691 BM. *Morton* 134 K. *Richardson* 124 BM. *Spencer-Chapman* 129 K; 649 K. *Thorold* 138 K. *Wollaston* 146 K. *Younghusband* 105 K. *?collector* 6114 PE.

II.4. *Cryptothladia chlorantha* (Diels) M. Cannon
Ching 539 E. *Forrest* 2482 E, K; 5777 BM, E, K; 10212 E, K; 21255 E, K; 28801 BM, E. *McLaren's collectors* N9 BM, E, K. *Rock* 5129 E; 16499 E; 23834 BM, E, K. *Sino–British Expedition* 1641 K. *Wilson* 3781A BM, K. *Yü* 15306 BM, E. *?collector* 5482 PE.

II.5. *Cryptothladia polyphylla* (Wallich ex DC.) M. Cannon
Bowes Lyon 2210 BM. *Cummins* s.n. K. *Dobremez* 501 BM. *Dungboo* s.n. K. *Einarsson, Skarby & Wetterhall* 209 BM; 1193 BM. *Gardner* 1419 BM. *Grey Wilson & Phillips* 741 K. *King's collector* 402 K. *Lall Dhwoj* 0402 BM. *Ludlow, Sherriff & Hicks* 16243 BM, E; 17459 BM. *Malla* 9176 BM. *McCosh* 381 BM. *Polunin* 668 BM; 1339 BM. *Polunin, Sykes & Williams* 4177 BM. *Schilling* 436 K. *Shrestha* 5126 BM. *Stainton* 4325 BM. *Stainton, Sykes & Williams* 1763 BM; 2984 BM; 6138 BM. *Wallich* 425 K, PE. *Wigram* 122 K.

II.6. *Cryptothladia ludlowii* M. Cannon
Cooper 4525 BM. *Kingdon-Ward* 12383 BM, K; 14310 BM. *Ludlow, Sherriff & Hicks* 16903 BM, E; 19050 BM, E; 20305 BM.

III.1. *Morina kokanica* Regel
Galubev s.n. MW. *Gnezdillo* 186 BM. *Gomolitzsky* s.n. E, K. *Von Knorring* 765 K. *Linczevski & Roshkova* 39 K. *Minkvitz* 41766 BM, E, K. *Neustrueva & Knorring* 4176A BM, E, K. *Neustrueva* 157 BM. *Pavlov* 71 MW; 396 MW; 482 MW. *Regel* 6/1880 BM, K, LE; 7/1880 BM. *Sovetkina* 1050 BM. *Tilchko* s.n. BM. *Vatolkina* 447B E, K.

III.2. *Morina coulteriana* Royle
Aitchison 407 BM, K; 746 K, LE. *Anders* 10979 W. *Battel* s.n. K. *Bellew* s.n. K. *Benham* 1919 BM. *Bor* 12289 K. *Bowes Lyon* 202 BM; 1095 BM, E. *Bunge* s.n. P. *Capus* 574 P. *Carter* 993 K. *Chiddell*

88 BM. *Clarke* 28767 BM; 30871 K. *Collett* 46 K. *Cooper* 5298 E; 5536 E. *Drummond* 14204 K; 22526 K. *Duthie* 935 BM, LE; 5661 BM; 25645 LE. *Eckburg* 9577 E. *Edelberg* 1783 W. *Edgeworth* 259 K. *Ellis* 272 K; 1348 K; 1881 K. *Evershed* s.n. BM. *Furse* 8048 E, K. *Gibbons* 607 E, K. *Giles* 58 K. *Gronbczewsky* s.n. K. *Gukun* s.n. MW. *Harbuckle* s.n. K. *Harriss* 16234 BM. *Hedge* 449 K. *Hedge & Wendelbo* 5228 E; 9444 E. *Huggins* 228 BM. *Kaletkina* 38 K. *Kingdon-Ward* 11996 BM. *Koelz* 13012 W. *Komorov* s.n. LE. *Kurushkaya & Nicrasov* 0887 BM. *Lace* 219a E; 1652 E. *Lindbery* 668 W; 917 W. *Ludlow & Sherriff* 1419 E; 1828 BM, E; 5719 BM, E; 8219 BM; 9123 BM. *Ludlow, Sherriff & Taylor* 5481 BM. *Munro* 1324 K. *Neubauer* 662 W. *Novitsky* s.n. LE. *Parmanand* 598 E. *Pinfold* 323 BM. *Podlech* 12348 E. *Rechinger* 31615 W. *Regel* s.n. BM. *Reid* III216 E. *Rich* B1082 K; 1095 K. *Robson* 2103 BM. *Royle* s.n. K. *Schlagintweit* 4181 BM. *Sherriff* 7350 BM. *Siddigh* 2269 BM. *Singh* 1771 K. *Stainton* 2785 BM, E. *Stewart* 3754 K. *Stewart & Rahman* 25376 BM. *Strachey & Winterbottom* 3 BM, K. *Thompson* 210 K. *Toppin* 412 K. *Vassiljeva* 5487 BM, E, K. *Watt* 441 E. *Wendelbo* 59 BM, K. *Zaprialiev & Tekutvev* 278 MW.

III.3. *Morina persica* L.

Aitchison 420 BM, K. *Alava* 10654 E. *Amsel* s.n. W. *Anders* 3738 W; 10722 W. *Anderson* 49 E. *Archibald* 2856 K. *Ascherson* 439 BM, E, K. *Atchley* 1034 K; 2239 K. *Aucher-Eloy* 754 BM, K. *Balansa* 796 BM, K. *Balls* 514 E, K; 1183 BM. *Baytop* 14357 E; 19927 E. *Behboudi* 1293E W. *Bledencvii* 5085 LE; 5723 LE. *Bokhari & Edmundson* 2036 E. *Börnmuller* 786 K; 4518 K; 9496 BM, K; 11955 BM, E. *Bourgeau* 240 K. *Borne* 3694 K. *Brant & Strangways* 549 K. *Calvert & Zohrab* 388 BM, K. *Carter* 1309 K. *Chick* 144 K. *Clarke* 24494 BM; s.n. K; s.n. E. *Constantintinon* H1507 K. *Coode & Jones* 2323 E. *Cooper* 4983 E. *Crookshank* 435 K. *Darrah* 467 E. *Davis* 10099 E, K; 16369 E, K; 20370 K; 46443 K; 47477 E, K. *Davis & Coode* 36591 E. *Davis, Dodds & Cetik* 19068 BM, E. *Davis & Hedge* 30051A E, K; 31731 BM, E, K. *Drummond* 25808 E, K. *Dudley* 35872 E, K; 36089 E, K. *Duthie* 336 K; 15603 K; 21847 K. *Edelberg* 1108 W. *Edmondson* 580 E. *Ehrenberg* s.n. K. *Ekim* 36 E. *Falconer* 534 K. *Flemburg* 851 E. *Flemming* 20 E; 61 E; s.n. K. *Fox* s.n. K. *Furse* 4098 K. *Gamble* 4213A K; 4308A K; 22819 K; s.n. K. *Gay* s.n. K. *Gerard* s.n. BM. *Gilli* 3881 W; 3882 W. *Grant* 17684 W. *Grebenchikoff* in 1936 K; in 1938 K. *Gubanov & Pavlov* 162 BM. *Guichard T/42/60 K. Haghighi* 6241T W. *de Halacsy* s.n. K. *Haradjian* 1248 E, K; 2360 E, K. *Harsukh* 15336 K. *Haussknecht* in 1865 BM, K; in 1885 K. *de Heldreich* 46 E, K, LE; 99 E; s.n. K. *Hewer* 998 K; 1352 E, K; 2042 K. *Hisbourg* s.n. K. *Kashkauli* s.n. W. *Kerstan* 1447 W. *Khan, Prance & Ratcliffe* 276 E, K. *Koelz* 11744 E, W. *Kotschy* 549 BM, K, LE. *Kotte* s.n. K. *Lace* 3869 E, K. Lack 4288 E. *Lambert & Thorp* 559 K. *Lammond* 2478 E. *Leonis* s.n. LE. *Liston* s.n. E, K. *Loftus* s.n. BM, K. *Madden* s.n. E. *Manisadjan* 56 K; 112 K; 145B K. *Marten* 16 E. *Mill* s.n. K. *Mooney* 4514 K. *Moussari & Transhahr* s.n. W. *Neubauer* 202 W. *Orphanides* 101 E, K. *Parkinson* 7366 E. *Parry* 251 E. *du Pavillon* 15 BM, K. *Pichler* s.n. K. *Post* s.n. BM. *Price* 916 K. *Rechinger* 5761 W; 16966 W; 31056 K, W; 32262 W; 34355 W; 47483 K, W. *Rich* 179 K. *Rix* 86 E. *St Lager* s.n. K. *Sawyer* 53 E. *Sibthorpe* s.n. K. *Siehe* 232 BM; 318 E. *Smith* 4107 BM. *Stainton & Henderson* 5452 K. *Stanf* 403 K. *Stewart* s.n. E, K. *Stribrny* 66 E; 68 E; s.n. E, LE. *Tebey* 2007 E; 2669 E. *Thompson* 49 BM, E; 654 BM. *Thompson & Clarke* s.n. K. *Transhahr & Moussari* s.n. W. *Walne* s.n. LE. *Warr* 10099 K. *Watson* 275 K. *Watt* 45 E; 90 E. *Wendelbo* 831 W. *Wiedermann* s.n. BM, K. *Winter* 308 BM. *Woronov* s.n. LE. *Zorab* 404 K.

III.4. *Morina longifolia* Wallich ex DC.

Abel 78 BM; *Bailey's collectors* s.n. BM. *Aitchison* 47 K; s.n. LE. *Bhattacharya* 24331 LE. *Bis Ram* 530 BM. *Burtt* 1215 E. *Clarke* 24238 K; 31086 BM. *Cooper* 4914 BM, E; 5106 E; 5597 E. *Duthie* 935 LE; 1157 LE; 13115 BM, E; s.n. BM, LE. *Dobremez* 521 BM. *Einersson, Skarby & Wetterhall* s.n. BM. *Falconer* 533 K. *Fuller* 854 K. *Gamble* 1495A K; 5666A K; 6518C K; 26917 K. *Giles* 727 K. *Griffiths* 2132 BM. *Komorov* s.n. LE. *Lace* 367 BM, E; 1497 BM, E. *Lall Dhwoj* 103 BM, E; 0608 BM, E. *Lance* 134 K. *Lawrie* 5448 BM. *Lowndes* 1376 BM. *Ludlow & Sherriff* 3567 BM; 7819 BM, E; 8275 BM; 9226 BM. *Ludlow, Sherriff & Hicks* 19581 BM, E. *Maclagan* 711 BM. *Nand* 251 E. *Osmaston* 67 K. *Parker* 3043 LE. *Polunin* 56/256 BM, E; 1449 BM. *Polunin, Sykes & Williams* 208 BM; 2608 BM; 4358 BM; 4423 BM. *Ram* 8942 E. *Reid* s.n. E. *Rich* 1255 K. *Ribu & Rhomon* 5509 E. *Schlagintweit* 10016 E. *Schlich* s.n. E. *Sherriff* 7373 BM. *Stainton* 4961 BM. *Stainton, Sykes & Williams* 1964 BM; 3388 BM; 3475 BM; 7376 BM. *Stewart* 44 E; 45 E. *Strachey & Winterbottom* 1 BM, LE. *Thompson* s.n. E. *Venning* K141 K. *Wallich* 426 BM, K. *Watt* 91 BM; 109 E; 445 E; 1944 E; 3300 E; 8833 E; 9597 E. *Wigram* 76 E. *Young* s.n. BM.

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Taxonomic index

Accepted names are in roman and synonyms in *italic*; new names are in **bold**, as are principal references. An asterisk (*) denotes a figure or map.

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Christopher R. Fraser-Jenkins

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Contents

Synopsis

This paper is a general introduction to fern genera in the Dryopteridaceae and Athyriaceae (Aspidiaceae, sens. lat.) of the Indian subcontinent and in particular to a forthcoming monograph of *Dryopteris*. Details of the methods of investigation, history of fern study, an extensive bibliography, and the phytogeography of the ferns concerned are included. The area is divided into 100 regions in four major divisions.

Introduction

This paper is intended to be a general introduction to representatives of the Aspidiaceous genera *Dryopteris* and *Polystichum* in the Indian subcontinent. These large and complex genera have often been ignored, or only scantily or fragmentarily dealt with, due to the taxonomic problems they raise. The author has prepared a monograph of *Dryopteris* which will be published later.

The Indian subcontinent is here construed as extending from the extreme western limits of the monsoon area, which are in eastern Afghanistan, throughout the Himalaya, through Pakistan, India, Nepal, Sikkim, and Bhutan to Assam and southward through Bangladesh and all of India and Pakistan to Sri Lanka (Ceylon). It forms a unit defined partly from a floristic point of view and partly for geographical and historical convenience, in view of its previous treatment as a unit by British botanists. The natural limits of the flora extend in reality beyond the east Himalaya into at least western China, but at present it is impractical to include the Chinese part even though it has been extremely important to consider Chinese species. The author is fortunate to have been working at a time when it has once more been possible to communicate with Chinese botanists and visit Chinese herbaria. It is clear from the high number of species and their affinities throughout the world that the east-Himalayan and west-Chinese region is a major centre of distribution of species of many genera, or at the very least an area where, as a result of an equable climate and the presence of mountain refugia, by far the greatest number of species have survived. Thus it is hoped that a detailed account, using modern knowledge and methods, of the species in the area will be useful for the study of the genera concerned throughout the world and especially in the rest of Asia.

Material studied for the monographs has been determined anew by the author and has come from the major herbaria containing Indian subcontinental material. Apart from the author's extensive collections (in BM), all the material of the genera concerned has been studied at the

following herbaria (abbreviations are according to Holmgren, Keuken & Schofield, 1981): K, BM, E, MANCH, CGE, LINN, LIV, P, L, B, BR, G, Z, UC, MICH, PPFI, RAW, ISL, LAH, PAN, PUN, DD, DBS, LWG, ASSAM, CAL, KATH, MH, KUN, IBSC, PE, SYS, & YUKU. Reference has also been made, for some of the rarer species, to S, US, W, H, LE, KYO, TI, TOFO, and KABA. All distributions given in the introduction and monograph are based entirely on specimens seen and determined by the author and not (except in a few stated cases) from records taken from literature, which are considered unreliable in the light of the large scale revision which has now been necessary in these complex genera. All the synonymy, except in a few stated cases, has similarly been investigated by examining types.

Some considerations for the study of ferns in Asia

The genus *Dryopteris* is possibly the most complex and difficult genus to study in the subcontinent, not only on account of its large size, but also because it contains groups of closely related species, often polyploids or apomicts, which are difficult to separate. It is closely followed in this respect by the other genera *Polystichum* and *Athyrium* and indeed all three suffer from their treatment in earlier years when quite distinct species were lumped together and often mistakenly identified as being the same as species from Europe. Even recent literature suffers from this problem. However, in recent years members of these genera have been carefully and fully elucidated in Europe, western Asia, North America, and Japan, and it is now possible to begin to apply the same detailed and critical methods of study to central- and southern-Asiatic species and to compare them properly with species from other parts of the world. It is important in this connection to appreciate the ranges of intraspecific variation, and to distinguish where possible between such variation and differences arising from the occurrence of distinct combinations of genomes, which in general delineate the different species at least in the first two of the genera concerned. Hence population sampling when collecting, and frequently the cultivation of variant plants side by side, are both considered to be extremely important to avoid the erroneous description of new species based on only one or a few, perhaps abnormal specimens.

Apart from the essential and basic recognition of the characteristic morphology of the various species, another principal method of approach to this study in Europe has been to attempt to gain an understanding of the systematics of the groups by cytological study of interspecific hybrids leading to genome analysis. Useful references to world-wide cytological reports are to be found in Löve, Löve & Pichi Sermolli (1977), though the original reports must be checked as they are frequently misquoted. In some cryptic groups the results may be merely confusing, and cannot be reflected in their taxonomy and nomenclature, as for example in the complex *Cystopteris fragilis* (L.) Bernh. aggregate (see Vida, 1974 and Lovis, 1977) in the genus *Cystopteris*; in others widespread genome homology may produce uninterpretable results, as in a number of phanerogam genera. But in general several Aspidiaceous genera contain species with distinct genomes clearly reflected in their distinct morphology, and are amenable to study by such methods, particularly the genera *Dryopteris* and *Polystichum*, though *Athyrium* appears to contain several cryptic groups. A complication that arises frequently in *Dryopteris* though, and to a certain extent in *Polystichum*, is the occurrence of apomictic species which show much variation, but in which individuals are unable to breed together, hence restricting gene-flow through the population. This reproductive isolation allows the preservation of any variants that occur, which may form slightly distinct populations by cloning. The plants are also more difficult to study cytologically because chromosome pairing analysis is only possible in a restricted number of spore-mother cells (those in the 16-celled sporangia), and since hybridisation with sexual species merely adds on extra genomes, it may be difficult in natural or artifically produced apomictic triploid or higher polyploid hybrids to ascertain from which genomes bivalents seen at meiosis may have originated. It is worth emphasising here the usefulness of mitotic (root-tip) counts in order to avoid possible (and all too frequent) confusion between 16- and 8-celled sporangia at meiosis, which results in an incorrect ploidy being published; also a diploid apomict and a tetraploid species may both have 82 bivalents and if 16-celled sporangia are in low numbers

and are not noticed in the apomict a report of a sexual tetraploid may be made in error. In addition root-tip counts may be made at any time of the year when the plant is growing, whereas meiotic counts can only be made on mature plants during the short time when sporangia are developing. In cases where the cytology does not clarify the situation, help may come from another method being increasingly used in modern studies, that of chemical analysis: for example, of the phloroglucides present in the stipe-bases of most *Dryopteris* species. Though in general less exact than genome analysis, this may supply the crucial information that allows understanding of the origin of a taxon, and hence may help to decide if it is really a distinct species or only a variant. Both these studies are merely beginning in much of Asia except Japan; in connection with the present work, for example, Professor T. Reichstein, of The Institute of Organic Chemistry, Basel, Switzerland, and Professor C.-J. Widén of the University of Kuopio, Finland, are carrying out analysis on a large amount of dried rhizome material of *Dryopteris* that the author was able to bring back from the Himalaya, south India, and China, and Dr M. Gibby, of the British Museum (Natural History), London, has carried out cytological checks on corresponding living plants, which it is hoped may be extended to genome analysis of certain groups at some time in the future. A rather large number of cytological reports on Indian subcontinent ferns have now been published, but it must be noted that as yet the nature of only a single polyploid species in the Dryopteridaceae of the area has been elucidated by genome analysis, and that (on *Dryopteris filix-mas* (L.) Schott) was carried out in Europe on European material. A similar situation applies in the Aspleniaceae, with four species all elucidated from Europe only, though work on the *A. laciniatum* D. Don (= *A. varians* Wallich ex Hook. & Grev., see Morton, 1973) aggregate is at present being carried out by Professor T. Reichstein at Basel. By contrast, on the European mainland, eight of the 13 known polyploid species of *Dryopteris* and *Polystichum* have been at least partially elucidated, six of them completely, and all 18 known polyploid European *Asplenium* have been completely elucidated. The figures for North America are now more complete still. *Athyrium* in Europe cannot be compared with Asia as it has only two species, both diploid sexual. It is therefore to be hoped that in the future more complete work may be carried out on some of the groups of Indian species, as a species has not been 'worked out' merely because a meiotic chromosome-count has been carried out. In this respect my study (Fraser-Jenkins, 1985) should be considered as a preliminary catalogue to aid such future work, and may well need to be added to and altered accordingly.

Study of the morphology, size, and degree of fertility of spores is another method which throws much light on the nature or identity of a species. Unfortunately this has been neglected for much of Asia, or, when it has been carried out, has often been of a vague general nature, covering one or two species from various groups instead of its somewhat more useful application to a particular group of species. Spore ornamentation is sometimes characteristic of a species, as may usually be readily observable with the light microscope, which may produce results as diagnostically useful as those from stereoscan studies, the latter often being more difficult to interpret. More importantly the mean length of the exospore (ignoring the perispore and also ignoring unusually small spores or those standing on end in the preparation), even from as small a sample as 20 spores from an individual, as long as they are fully ripe, gives information relevant to ploidy within a group, and often more reliable information than that from stomatal guard-cell size, which may vary more markedly depending on environment. Thus a pair of closely related species within one group (but not across differing groups with unrelated species, whose basic diploid spore size may differ from case to case), where one is diploid and another tetraploid, almost always, so far as has been discovered, shows some spore-size difference, though there may be some overlap. The non-abortive spores of an apomict are also markedly larger than those of a related sexual diploid species, being twice the ploidy of a normal spore, and the same ploidy as the sporophyte plant-body. It is also highly useful to observe whether the spores are partially abortive as in an apomict, or uniform as in a sexual species, or fully or almost fully abortive (frequently ± shapeless, or markedly irregularly shaped, with thickened or ± irregular perispores) as in a spontaneously originating sterile hybrid. But care must be taken to ensure that the sample is fully ripe, with black sporangia in the process of dehiscence at the time of collection of the specimen, as young spores are smaller, and very young ones are small, without

perispore, and appear white or pale; samples that are too old and have long ago dehisced (with brown sporangia) have lost the heavier, good spores first and may have an unusually high proportion of abortive ones left over. It is therefore important to distrust occasional isolated spores in samples with very few spores left, which could be contaminants, even after washing the pinna under running water, though this reduces the number of loose spores considerably. Sometimes breaking open individual undehisced sporangia, using two slides squeezed slightly together, or a fine needle, or by placing in concentrated lactic acid on the slide, may produce reliable results when there are very few spores left, at least if the spores are good and unaborted. It is important, too, to distinguish between sporangial abortion due mainly to drought and true spore-abortion due to hybridity, and dust in the sample must be distinguished (with a dark background if necessary) from abortive spores so that clean samples are always preferable. It is because of the usefulness of such spore studies that it is vital that cytological voucher specimens have ripe spores wherever possible, even if plants have to be cultivated to allow this.

All these studies need more emphasis in Asia in order to allow the taxonomic treatment of a group to reflect more accurately the systematics. In some cases it is necessary to understand that what has been seen as variation may really arise from the occurrence of a distinct combination of genomes, which may then indicate that treatment as a distinct species may be warranted if it is also upheld by the important artificial criterion that the plants can be readily morphologically distinguished, not only by microscopic characteristics (in the Dryopteridaceae at least). Alternatively, taxa described as different species may be superfluous due to the overlooking of earlier names (often from different areas in Asia), or, a more frequent and much more troublesome situation, may merely be variants described as species in error (often from too few specimens) due to a previously unappreciated range of infraspecific variation, particularly that which occurs in apomicts. Variation in allopolyploids may also cause some confusion which must be sorted out; in Europe at least some have been observed to veer towards the morphology of one ancestral species or the other from locality to locality, perhaps due to a particular set of environmental factors bringing out a certain phenotypic response from the mixture of genes originating from both ancestors. In other species local or widespread ecotypes or geographical variants may form which can only be adequately treated (often as subspecies) once their nature is understood.

An even more immediately important area of research which has been but poorly attended to throughout Asia is that of typification, which allows consequent accurate identification. Without this a publication may be highly confusing, especially if, as is often the case, material is cited without numbering and thus cannot be properly or conclusively checked at a later date in a herbarium. The problem arises partly from the fact that most of the type specimens are stored in Europe and funds are often not forthcoming to allow visits to see them, while publications in India seldom give clear descriptions and illustrations. Nevertheless typification has often merely involved interpretation from the name or reading the protologue of the publishing author (or accounts of later authors) rather than studying the relevant type specimens, which are for the most part preserved and available in London (K and BM), Paris (P), or Berlin (B), with south-east Asiatic types usually in Leiden (L) or Berlin (B), Chinese mainland ones in Peking (PE) and Canton (IBSC), and Prov. Taiwanese specimens in Tokyo (TI) and Kyoto (KYO). Otherwise many identifications depend on those carried out on herbarium collections some years ago which were sent from the subcontinent to Alston, Ching, and others, and which were generally not accurate enough for the modern post-cytological elucidation of complex groups or confused species. In many cases it is not easy to select a representative type when an author may have had mixed concepts, or cited a number of specimens, or inadvertently published a name that was previously invalid. In this, as in any study, it has been necessary to unravel and understand the validating author's concept before selecting a lectotype. Only in this way can an author be sure of the identity of a species he is dealing with. Typification has almost invariably been carried out by reference to the original material in the present studies (Fraser-Jenkins, 1985), except in a few stated cases (where the type is cited without an exclamation mark after it) and it is hoped that the photographic illustrations of the species and mention of their diagnostic

characteristics, following this typification, will provide a helpful basis for identification in future studies.

Although keys are provided for each section (Fraser-Jenkins, 1985), it should be pointed out that the species concepts of later workers should not be based upon the so-called 'key-characteristics'; these may be misleading, as keys for complex fern genera frequently do not hold true, and falsely emphasise a particular characteristic which in reality is only a tendency. It must be pointed out, too, that because in these genera many of the species vary considerably, it must be expected that many individuals may not readily be keyed out with a dichotomising system based on presence or absence of a few artificially weighted characteristics. Yet the species may be readily separated by the human brain once actual material is seen with the correct name attached; this is done by means of observing and partly intuitively summing up a combination of characteristics. The author is firmly of the perhaps slightly unorthodox opinion that comparing specimens with a photograph of each species is both more immediate and more accurate than the use of a key. Reference may be made to both the illustrations and the text (to discover which features to look for) in the monograph (Fraser-Jenkins, 1985) and checks can be made on the spores for evidence of hybridity, apomixis, or tentative ploidy as indicated by spore-size, when it is expected that accurate identifications will ensue. In cases where important material that has to be identified seems not to fit the best course would be to carry out a meiotic chromosome count if time and materials permit, and to make comparisons with material known to be correctly identified in herbaria. For this purpose the author has set about determining material in many of the relevant herbaria when time was available, or, more reliably, citing specimens in the text.

Much detailed attention has also been paid here to questions of nomenclature and the application of the present *International code of botanical nomenclature*. As a result of careful study of questions of nomenclature and typification, there are several nomenclatural changes to be made which have lain unnoticed or semi-dormant in recent literature. Many of these involve names attributed to Wallich, who, with his large series of mixed collections with invalid names sent out to numerous institutes and botanists of his day, unwittingly caused lasting trouble and difficulties. Yet there are still many workers, particularly Indian botanists, who do not number each plant separately in their collections of herbarium material and to a certain extent run some of the same risks when their collections are utilised in their publications. Far too many mistakes have been perpetuated by following previous authors uncritically, rather than studying each case anew when compiling a work for publication. The author can only apologise in advance for any inaccuracies or omissions he has failed to notice.

Finally some remarks on the making and labelling of specimens may be of value. It is emphasised that a good specimen can be easily identified and its characteristics more easily seen, whereas a poor specimen can often create considerable difficulties. With most of the larger ferns undoubtedly the most useful features are the basal half of the frond and the scales near the stipe base. Thus a specimen whose basal and lower-middle pinnae are properly spread out and visible is of far more use than one where the basal pinnae (with their highly important lowest pinnules, especially the lowest basiscopic one) are either folded up or obscured by the upper part of the frond lying over them. An ideal large specimen should have the stipe bent sideways just below the lamina and then again upwards shortly before the edge of the herbarium sheet is reached, care being taken during collecting and drying never to handle the frond by the stipe, which causes the often highly characteristic scales to be rubbed off. The bottom of the lamina can then be placed at the bottom of the sheet. It also helps in all the dryopteridaceous ferns (at least) if the upper surface of the lower part of the lamina is displayed so that its important surface texture and colour are visible; the under surface is rarely as informative. However, an important feature of the under surface is the sori and their indusia, and in order to display them the tip of the frond may be bent under the rest of the frond from near the top of the sheet and deflected to one side. With smaller specimens some fronds may be mounted with the top surface uppermost and others the other way up on the same sheet. Particularly with the Polypodiaceous and epiphytic ferns parts of the creeping rhizome with its helpful scales should also be preserved, attached to the fronds, but if possible without earth, which contaminates the spores and makes them harder to interpret. Whenever possible, specimens with ripe (black) sori should be selected and those with

young sori avoided unless an extra frond is deliberately included in order to show young indusia. Once good specimens have been made it makes them of far greater value and use if full localities are given on the label; all too often, especially with Kumaon and Nepalese localities, the label merely indicates a very small and obscure village or stream and the Indian State concerned. These obscure localities may be extremely difficult to trace and may involve hours searching detailed maps; frequently they cannot even be traced by asking in local botanical institutes, because, unless the original collector can be found, few of the collectors have any wide knowledge of their country. A properly written label must indicate the approximate altitude, direction, and approximate distance from a village and then place the village in relation to large and well-known towns, etc.; in very remote regions a map reference may be of assistance if no well-known towns are nearby. Separate plants should be numbered separately and the number and date clearly indicated on the label; thus when they are cited in any publications the exact specimen referred to can be traced by later workers.

A review of Indian subcontinent fern study

A general bibliography of the more important publications (unless they are specific to certain genera) appears after the end of this account of the literature, but it is of use here to sum up the work of the major authors and fern-workers in a chronological review, making note of botanical advances.

The first Indian ferns were described by Linnaeus (1753) and later amplified by Swartz (1801 and 1806), but it was not until Professor D. Don [1799–1841] published his *Prodromus Flora Nepalensis* (February 1825), that a spectrum of the more obvious Himalayan fern species was described. Don drew on the collections of Hamilton (whose former name was Buchanan), Roxburgh, (whose collections were published posthumously with the help of Griffith), Wallich, and others. Unfortunately, Don's species are often very difficult to typify, his descriptions are usually rather too vague to allow identification by themselves, and his genera, such as *Polypodium, Nephrodium, Aspidium,* and *Asplenium*, were broadly delimited by modern standards. What remains of his original specimens are mostly to be found in BM. These are almost all the collections of Hamilton, and have Hamilton's rather large writing on them, with the locality as given by Don; many of them (including a very few Wallich collections) also bear a small label and name written in Don's distinctive, small handwriting, with slits cut into the label through which the specimens were originally inserted, and with a reference to Don's *Prodromus*. Hamilton collected in Nepal from 1802–03 for the East India Company. But most of Don's species had Wallich collections as their types, and only a few of these survive today with annotations by Don; it is possible that, if Don ever had such specimens in his possession, which is doubtful, they may have been destroyed in a fire long ago (Christensen via Ching 1980, pers. comm.), though the author has been unable to verify this. Some other types also exist in Paris (P) and Bruxelles (BR). At present the most accurate course of action when typifying Don's species based on Wallichian collections, which do not exist bearing Don's label at the BM, is to draw on the nearest to the original East India Company Wallich material. This is either that distributed to Sir W. J. Hooker, now in the general herbarium at Kew, or preferably, the separate Kew–Wallich herbarium, which contains a large proportion of the specimens left in the East India Company herbarium after Wallich's main distributions, and thus the bulk of the specimens Don actually worked on. It is necessary to lectotypify the specimens at Kew by reference to Don's description and, if they exist, to Don's names written on the sheets by other authors, and, most importantly, to the sense in which Sir W. J. Hooker and other authors of the last century took Don's names, while ascertaining that the specimen concerned was collected before 1825, the date of publication of Don's work. It clearly requires a full knowledge of what specimens exist, and of both the genus concerned and the sense in which other authors took the name, before lectotypes are selected, and this should not be done only by reference to the somewhat scanty material present in Indian herbaria. Morton (1967, 1973) has made some useful comments on some of Don's names, among others. Don came under severe criticism at the time (Lindley, 1825; Wallich, 1830) and his work was largely deliberately ignored mainly for his independent

nomenclature, because he generally did not use Wallich's (or others') names or numbers, even for Wallich collections, thus causing endless confusion today. It appears that though he was commissioned to work on Hamilton's collections he unauthorisedly took over many of Wallich's too, while Wallich was still working on them in India before he died. Lindley (1825) was furious that Don altered all Wallich's names and substituted his own, and criticised Don as an uneducated interloper, while Wallich (1830) refused to use Don's names, though they were legitimate. He was upset that Don rejected his names for no good reason and complained that he had never in his 'life experienced such conduct, or anything in the remotest degree like it, from any other quarter'. Unfortunately, his contemporary's refusal to acknowledge his work, though justified, has contributed markedly to so little being known about many of Don's species at present. Some of his names have caused further confusion as it has been unclear whether they were independent later homonyms of names published by Swartz, etc., or whether they were really intended to be based on an earlier author, who is sometimes cited at the beginning of the genus. From analysis of the 14 apparent later homonyms among the 64 (actually 66, or 72 including fern allies) new species of ferns in Don's work (Smith & Fraser-Jenkins, 1981), it is clear that Don's later homonyms are indeed independent of earlier authors; they are only based on earlier authors when he cites the authority in the account of the species concerned. This is the case even when the two species are the same, which occurs with a few of the homonyms (e.g. *Aspidium paleaceum*, a name which had long been under dispute). Don described three *Dryopteris*, six *Polystichum*, and three *Athyrium* species, as well as species in other genera.

The extensive collections of Dr N. Wallich (formerly named Wolff and coming originally from Denmark) [1786–1854], for the East India Company, made mainly in Kumaon (coll. Robert Blinkworth), Nepal (from the surroundings of the Kathmandu valley) and Khasia, from 1815 to 1832, and later up until 1849, were drawn on by a number of authors. But unlike Don they used the names that Wallich had given to his specimens and had circulated as invalid names, without descriptions, on the herbarium sheets, or in his numbered catalogue lists of 1828–1832 and 1847–1849. Unfortunately, Wallich never described these ferns himself and much of his series of collections, originally at East India Company House and later at the Linnean Society before going to the Kew–Wallich herbarium, was distributed by him all over Europe and later to India, and sometimes contained muddled labels, or more frequently contained more than one species per sheet or catalogue number. Much of the material sent to European botanists was intended to be on loan, but it was not until Clarke reorganised the Wallich herbarium that specimens were returned and reunited with the remnants of Wallich's material from the Linnean Society to form the Kew–Wallich herbarium. It is therefore sometimes very difficult to ascertain the concept of an author who first validated a Wallich name, and so find out to which species the name applies, without taking account of which particular specimen of the number cited the particular author had in mind. Also different authors often meant different things by the same name as many did not realise that they should have referred to the earliest valid publication of a Wallich name (by another author) as the protologue of that species, and have decided on the type accordingly. Indeed in some cases a name attributed by an author to Wallich may really be typified from the author's concept, as shown in his description, as a species different from any of the numerous Wallich specimens of the relevant catalogue number. Nomenclatural confusion and typification problems persist to this day, not helped by the vague localities which Wallich often gave, such as 'Napalia' (Nepal). Thus although Wallich considerably increased the number of species known at the time, another result of his work has been a great deal of confusion, all of which requires clarification, species by species. Some species were given three or even four names by him, and a confused modern researcher ensnared in nomenclatural questions may well be forgiven for wishing that Wallich had collected in unicate and never named any of his specimens. In all he collected about eight *Dryopteris,* seven *Polystichum,* and eight *Athyrium* species from the Indian subcontinent, named under several different genera and under various specific names, or overlooked among the collections. It is only thanks to the two Hookers' and Clarke's careful work on his herbarium that sense can be made of it, and perhaps fortunately, rather few of his names with their attendant typification problems stand today.

At about the same time as Wallich's collecting, C. L. von Blume, whose herbarium is in

Leiden (the type specimens bearing his signature 'Bl.'), published a large number of fern species from Java in his *Enumeratio plantarum javae* (1828), several of which occur in the Indian subcontinent, mainly in the east Himalaya, south India, or in Sri Lanka. Some have also been mistakenly reported from the area due to misidentification, and it is possible that others may yet have been overlooked. Hence the importance of the herbarium at Leiden for studies of Indian ferns, some isotypes of Blume's also being at Kew.

Following Wallich's distributions a number of the important early German authors, whose type specimens (including those that are Wallich collections) are mostly in Berlin, published some of his or their own species, for example: Sprengel (1827), Presl (1836) and (1851) (without description, so invalid), Kunze (1851, etc.), Kuhn (1869), and Mettenius (1856–69). Kunze and Mettenius between them published a rather large number of species from all over Asia as well as the Indian subcontinent and their works are therefore of considerable importance for the area. Kunze's types were mainly destroyed during the Second World War at Leipzig, but isotypes that he saw usually exist in Berlin (with some at Kew), apart from his south-east Asian types which are mainly at Leiden. Of considerable importance, too, was the upsurge of many, mainly British, botanist-collectors (with a few German ones, mostly employed in India, and one or two French voyagers-cum-botanists), who began in earnest last century, and continue to the present day. The earlier ones included Beddome, Bourne, Freeman, Gardner, Hutchison, Meebold, Perrottet, Schmid, Thwaites, Trimen, Walker, Wall, and Weigle, from south India and Sri Lanka; Aitchison, Anderson, Atkinson, Bates, Beddome, Blanford, Bliss, Brandis, Cattell, Cave, Clarke, Collett, Duthie, (and his collectors Harsukh and Inayat), Edgeworth, Falconer, Gammie, Gamble, Gatacre, Haines, Harriss, Hooker (fil.), Hope, Jacquemont, Jerdon, Jukes, King (and his collectors Kunstler, Scully *et al.*), Lace, Levinge, Macleod, the two Mackinnons, Marten, McDonell, Meebold, Prain, Rawson, the Schlagintweits, Smith, J. L. Stewart, Strachey, Thomson, Treutler, Trotter, Wight, and Winterbottom in the west Himalaya, Darjeeling, and Sikkim; and Booth, Clarke, Griffith, Hooker (fil.), Hutton, Mann, Meebold, Thomson, Saulière, Simons, and Watt in the east Himalaya. A number of published works by some of these collectors mention ferns, the less comprehensive ones including Aitchison (1881–1882 & 1888), Anderson (1863), Blandford (1886, 1888, 1889), Cattell (1877), Collett (1902 & 1921), Duthie (1906), Ferguson (1880), Griffith & Roxburgh (1844), Decaisne in Jacquemont (1844), Marten (1909), Prain (1903), Strachey (1906), Thwaites (1864), Trimen (1885), Trotter (1889), and Wall (1873). It should be noted here that Thwaites, who distributed his specimens to many herbaria from Peradeniya Botanic Garden, Sri Lanka, used a system of numbers (e.g. C.P. 1368, etc.) based on the catalogue of plants at Peradeniya and many of the numbers were used for different gatherings and may contain mixed species, so that the numbers cannot be treated like modern collection numbers. C.P. numbers were also attached to collections of Gardner and some others, and are indexed in Thwaites' book.

It is convenient to mention here too, in connection with the British botanist-collectors, Dr T. Moore of Kew, who did not visit India but named a number of Indian species among his works, often in his *Index filicum* (1857–1862). This was not completed before his death, only reaching as far as *Goniophlebium* in alphabetical order, so that several of his species (in *Lastrea, Polystichum,* etc.) were not validly published except for those which appeared in obscure places such as horticultural works (e.g. Sim's catalogues of 1859, *Gardeners' chronicle,* etc.). J. Smith of Kew in his *Historia filicum* (1875) also listed a number of Indian species, including Wallich's names, but without descriptions, his herbarium being at BM. Often overlooked, but of importance, are the horticultural trade catalogues of R. Sim (1859, 1866, etc.) which have also provided some early validations of Wallich names.

Of the British botanists, four deserve special mention as having produced outstanding, detailed works, as yet unsurpassed in many respects, which together form a set of the most important references, vital for any workers on Indian subcontinent ferns. The four are Hooker (senior), Beddome, Clarke, and Hope.

The first of these, Sir W. J. Hooker (senior) [1785–1865], Director of Kew, never visited India, but nevertheless published a number of important works of monumental scope, dealing with ferns world-wide and placing and ordering the species in their genera more carefully than

had been done before; these include Hooker & Greville's *Icones filicum* (1827–31), Hooker's *Species filicum* (1846–1864) in five volumes, and Hooker & Baker's *Synopsis filicum* (1865–1868). Altogether Hooker dealt with approximately 14 *Dryopteris*, 13 *Polystichum*, and 15 *Athyrium* species from the area, and, apart from Don, was the first botanist after Wallich to have access to the rich East India Company collections. Wallich had also sent Hooker a set of his specimens, starting in 1818, and Hooker published numerous details of this collection in his various works. Hooker's set of these ferns (combined with others) is in the Kew general herbarium, usually bearing the circular stamp 'Herbarium Hookerianum 1867' on the sheets, and should normally be referred to for the types when typifying names attributed to 'Wallich ex Hooker', though if specimens are missing it should be borne in mind that he also worked on the rest of the Wallich material from the East India Collection which is now best represented by the Kew–Wallich herbarium. His son, Sir J. D. Hooker (fil.) [1817–1911], Director of Kew, travelled extensively in the Himalaya, collecting mainly with Dr T. Thomson, both in the west Himalaya and in Sikkim and the east, and deposited valuable sets of specimens at Kew (with duplicates elsewhere) collected from 1847–1852 and given to Kew in 1867, bearing the same Herb. Hooker stamp on the sheets. Details of his journeys can be found in his *Himalayan journals* (1855, etc.), but though he went on to produce the *Flora of British India* he unfortunately did not include ferns. His other major contribution was the partial reorganisation of Wallich's collections from 1847–1855 at the Linnean Society, including the sending of a partial set to Kew (apart from that already sent by Wallich to his father) and to Calcutta (see Clarke (1913), and anon. 'Sir J. D. Hooker', *Kew Bulletin* **1912**: 5).

Lieutenant-Colonel R. H. Beddome [1829–1911] lived in southern India and was the Conservator of Forests, Madras. He collected slightly later than J. D. Hooker, between 1857 and 1898, and published his two volume, *The ferns of southern India and Ceylon* (1863–64), describing and figuring all the species known to him at the time, including numerous new species. Though less familiar with the north than the south he went on to publish the two volume *Ferns of British India* (1865–70), with a *Supplement* to both his works (1876), and the excellent, *Handbook to the ferns of British India* (1883), which latter, together with the *Supplement to the handbook* (1892), is the most comprehensive book on Indian ferns to date. In all, his contribution to the understanding of Indian ferns was probably greater than that of any other worker and he was able to recognise about 26 *Dryopteris*, 22 *Polystichum*, and 20 *Athyrium* species. His types, annotated on the bottom of the sheet in his somewhat thin, rather sloping, handwriting are mostly at the BM (including most of the specimens he illustrated) or otherwise at Kew. Recently, a *Companion to Beddome's handbook* by Nayar & Kaur (1974), has been produced in recognition of the fact that there is no modern fern-flora of India. It has attempted to bring up to date the nomenclature of Beddome's work and is a useful publication, though generic concepts were somewhat out of date or inaccurate in places. But it suffers from the drawback that the authors did not see Beddome's types (Kaur, pers. comm. 1979), but tried to unravel the jumble of other authors' opinions as to what Beddome meant, which has resulted in much confusion and unreliability, the names not being identified, but many concepts indicated.

Beddome's lead was followed by C. B. Clarke [1832–1906] who made extensive, detailed, and carefully numbered collections, superior to those of many collectors even today, from all over the Himalaya, including the now virtually inaccessible mountains of eastern Assam. He then went to Kew and was responsible for numerically arranging (between 1881 and *c.*1887) the Wallich collection according to Wallich's list, then housed in the Linnean Society buildings in London, and for adding many of the missing numbers which were returned from various European herbaria at his request. These later became the separate Kew–Wallich (K-W) herbarium of today (see Clarke, 1913) and may be taken as the types of names attributed to 'Wallich ex Clarke', though not, as Clarke believed, of all Wallich names, which depend on the concepts of the validating authors and the specimens they saw, or which are most representative of their concepts. Clarke's major fern publication was his *Review of the ferns of northern India* (1880), based mostly on his collections. In it he recognised many of the more critical and previously unrecognised species, though he made occasional muddlings of names or, in one or two cases, dealt with the same species under two names, and following earlier authors, tended to

reduce too many species to varieties of well-known European ferns, such as *Athyrium filix-femina, Polystichum aculeatum*, and *Dryopteris filix-mas*. But his work is usually accurate and is of fundamental importance for the area. Unfortunately, he did not select types and gave only the ranges of his species rather than citing specimens or localities; but the best material from which types of his species or varieties may be selected is represented by his specimens at Kew, or otherwise at BM, though duplicates exist in several other herbaria.

The last of the 'golden age' of British fern collectors in India was C. W. W. Hope [1832–1904] who collected mainly in the Simla area, and followed this up, on returning to England in 1896, by careful work in herbaria. Those he worked through include DD, CAL, P, DBN, LIV, BM, K, MANCH, and E. He developed an intuitively good 'eye' for different species, especially in *Dryopteris* and other large and critical genera, probably being the most careful and detailed of any fern-workers in the area to the present day, as his annotations at Kew and elsewhere show. He frequently recognised an obscure species, not generally recognised until much later, as being distinct, even if he had no name for it. Some new species were published in his paper, *Three new Lastreas from Assam* (1890) and others in his *Ferns of the Chitral Relief Expedition* (1896), but most were in his *Ferns of the north western Himalaya* (1899–1904). This latter contains perhaps the finest fern drawings (by Brown, Fitch, and others) seen in any European or Asiatic literature and which, unlike most, capture the look of the species and match in every detail the corresponding BM specimens. It is also the most detailed and comprehensive work yet published on north-west Indian ferns and deals with 17 *Dryopteris*, 16 *Polystichum*, and 15 *Athyrium* species from that area alone. It is unfortunate that his work did not extend to other areas as well. He, like Clarke, did not select types, but he cites numerous specimens in detail and it is usually possible from his discussions to select lectotypes with which the name is clearly associated, at Paris, the British Museum, Kew, or sometimes from Blanford's herbarium in Manchester or the Forest Research Institute at Dehra Dun. The main part of his herbarium is in Paris (P), with originals of his illustrations at BM.

At the turn of the century there was a lull in the contribution of British botanists to Indian pteridology, but Dr Hermann Christ of Basel [1833–1933] filled this gap with his work on Chinese ferns. His herbarium contains specimens sent from Chinese collectors and most of his types and is in the Museum National d'Histoire Naturelle in Paris (P). Many of his numerous papers recombined Clarke's varieties as species, or gave them valid names, or described new species and varieties, common to both sides of the Himalaya in many cases. He brought to attention earlier works by Franchet, Diels, and others, and worked mainly on the collections of Biondi, Bodinier, Cavalerie, David, Delavay, Ducloux, Esquirol, Faber, Farges, Franchet, Faurie, Giraldi, Henry, Hugh, Léveillé, Maire, Martin, von Rosthorn (as published by Diels from von Rosthorn's original specimens at Oslo (O) and Berlin (B)), Scallon, Scortechini, Soulié, Taquet, and Wilson. These were mostly French (with a few Italian, etc.) botanist-missionaries who collected in China and whose material is mostly in Paris, with some duplicates at Edinburgh, Kew, BM, and Berlin. Christ probably had a greater general knowledge of ferns world-wide than anyone else before or since, and during his long life came to understand them in detail similar to that of post-cytological work.

He later corresponded with another remarkable worker in his field, Dr C. F. A. Christensen of Copenhagen [1872–1942], whose many publications began with the phenomenal world-wide *Index filicum* (1905–6), with *Supplements* (1913, 1917, and 1934) (and see Pichi-Sermolli, 1965). This listed all the world's fern species and provided many new combinations for Indian species, or reduced others to synonyms to create what is usually a more or less accurate synonymy of the species. He thus included both Christ's names (some of which were redescriptions of his own or others' species) and those of Rosenstock from S. China and S.E. Asia, which had remained rather little-known. The types of Rosenstock's species are mostly in Stockholm (S), or Leiden (L), with some at Berkeley, California (UC) and duplicate specimens were well distributed elsewhere. The index supplements were continued by Pichi-Sermolli (1965) and have been compiled as card-indexes since then at Kew, a further publication being much needed, as it is long overdue and its delay is somewhat inconvenient in the light of the large amount of modern and often local work, which can be difficult to trace. It is now likely to be completed at Kew

before long by Parris *et al.* (in prep.). Christensen clearly recognised the modern genera, such as *Dryopteris* (instead of *Neophrodium* and *Lastrea*), from which he separated the thelypteroids in a major step forward (1938), *Polystichum* (instead of *Aspidium*), and *Athyrium* (instead of *Asplenium*); all being confirmed by modern study (see: Christensen (1938), Holttum (1947) and also Holttum's subsequent work, including his series of papers on the thelypteroids of the Old World, Sledge (1973), Lovis (1977), Pichi-Sermolli (1977), and Ching (1978) for recent details of generic and family distinctions). Christensen's herbarium, containing fragments or duplicates of a great deal of important type material, is mainly at the BM, with duplicates at Copenhagen (C). His shorter papers included several very useful ones dealing with a large number of collections of Chinese species, whose types he always took the trouble to examine, and which he related to Indian species.

More Chinese work, which continues in the fore-front of fern-work on the Asian flora today was carried out by Professor Ching, Ren-Chang of Peking, in earlier days a colleague of Christensen, who made extensive visits to western herbaria in the 1930s and is still working actively at present. His publications, like Christensen's, have been of major and general importance, especially in terms of detailing generic limitations in a multitude of families, and his *Revision of Chinese and Sikkim Himalayan Dryopteris* (1936–38) lists a large number of species of *Dryopteris* and related genera with full details, including synonymy and distribution. It also separates various other genera, including *Ctenitis* (with its confusing *C. apiciflora* (Wallich ex Mett.) Ching aggregate, often mistaken for *Dryopteris*). He has published numerous other papers, describing, among many others, new species of *Dryopteris, Polystichum,* and *Athyrium* from the immensely rich Chinese flora, many of which species are relevant to India too, though it should be said that there are some typification problems, since a fair proportion of Ching's photographs of type specimens made in the 1930s do not in fact represent the correct type specimens. Present major projects in which he has played a leading part are the *Flora xizangica* (Tibet) and *Flora reipublicae popularis sinicae*, both now in active preparation, the ferns for the former (Ching & Wu, 1982) being nearly complete. Both are of major relevance to the Indian subcontinental flora. It is obvious, however, even though it is a matter of opinion, that much of his work suffers from over-splitting at the generic and species level, many of the so-called species being too readily described without further study from single herbarium sheets which often represent juvenile plants or very slight phenotypic variants well within the species. This applies even to his earlier work but is more markedly the case with his most recent publications such as the *Flora tsinglingensis*; the *Flora xizangica*, in particular, suffers badly from it. Indeed it must be said that continued publication of names of 'new species' in this way will cause many years work for future botanists simply to be able to unravel and sink the taxa concerned into their proper species, particularly as many of the types are poor specimens which are difficult to identify and have been published at species rank instead of forma to which they usually more properly belong, if indeed any taxonomic recognition is necessary. However, hidden among the names there are good species as well, which perhaps compounds the difficulties, but makes his work of great value and importance. For an example of the problems involved in studying at Peking, *Dryopteris* in the Peking herbarium (PE) contains (1982) some 600 manuscript names, several used more than once, which appear to be referable to only about a fifth or less of that number of species (according to most western species concepts); most of the names are readily referable to well known species, and effectively the bulk of the specimens in Peking herbarium are thus unidentified and have never been fully used for mapping or other purposes. It is unfortunate, too, that about three-quarters of the 'species', even those published some time ago, still consist of only one collection, or sometimes two. A similar situation occurs with *Polystichum*, Athyrioid ferns, *Lepisorus* and other complex genera, while some of the genera too may be excessively split up and involve too rigid a reliance on a particular key characteristic to allow all the species to be naturally placed. This is due mainly to following a species concept quite different from modern biosystematic concepts elsewhere and it appears that each observable variant is in general recognised as a species. The disastrous effects of the cultural revolution (from *c.* 1965–1976), which temporarily prevented modern species concepts and cytological and field studies from making their influence felt at a most crucial time, are also much to blame. Such

studies are now beginning on a remarkable scale and with considerable determination in China and will certainly balance the excessively artificial species concept used there with a more natural biological one in time. Ching's monumental work with its many correctly described species, is of great importance as some of his earlier species not only stand, but show a remarkable degree of foresight; it is to be hoped that the present atmosphere and revitalised attitude towards academic research in China, and contacts with foreign research workers, will help to overcome the problems that have occurred, and that an excessive profusion of new 'species' and 'genera' will not continue to be described. There is no doubt that the standards, thoroughness, and quality of Chinese work are indeed very good and that work of the highest quality will doubtless ensue.

Despite the problems mentioned above Ching may be considered the foremost authority on ferns alive today. His types are mainly at Peking (PE), Sian, and Canton (IBSC). Apart from him there are well over a dozen active fern workers in China at present, many of them students of his, including Wang, Zhong-Ren, Shing, Kung-Hsieh, Ling, You-Shing and Ying, Jung-Sen at Peking; Hsieh, Yin-Tang at Sian; Wang, Jian-Zhong at Shenyang; Kung, Hsien-Shiu at Chengdu; Wu, Su-Kung and Chu, Wei-Min at Kumming; Wang, Chu-Hao at Canton and Chu, Pei-Shi at Shanghai. Much work is at present being done on a series of local floras, province by province, including the provinces of Kiangsi, Tibet (Xizang), Szechuan, Yunnan, Kweichow, Kwangsi, Hupeh, Chekiang, Fukien, Kwangtung, Hainan, and Shantung, which are now either published or in active preparation; it is to be expected that many important new geographical records will result, especially once superfluous species have been eliminated. But is also hoped that more emphasis will be given to monographic studies, as in some ways local floras are premature when the genera themselves are not well known: a few good generic monographs covering all of China (incl. Prov. Taiwan) and taking account of the species of the Indo-Himalaya, S.E. Asia, and Japan would be of great value.

It should be noted that in the new floras the orthography of species since the last two years in China has been converted to Pin-yin spelling by governmental decree, which has resulted in some names, particularly those containing the letters Q, X, C, Z, etc., becoming quite different in pronunciation according to various European or Latin values of the letters, from the way place names are pronounced in China. It is to be hoped that this may be changed as it is somewhat against the spirit of the *International code of botanical nomenclature* (Voss *et al.*, 1983).

A somewhat overlooked area of work carried out in the first quarter of the century was Hayata's study of the ferns of Taiwan in his *Icones plantarum formosanum* (1914–19), followed by Tagawa's *Studies on Formosan ferns* (1940–1949), and more recently the less comprehensive *The flora of Taiwan* by Li *et al.* and De Vol (1975), and some interesting papers by Serizawa (1970–76), Tsi (1973), and Tsai & Shieh (1975, 1977). Though Christ (1904) drew on some of the early collections of Faurie and Taquet from Taiwan, it is only now coming to light that there is a very large and considerable floristic connection between the west and east Himalaya and Taiwan, so that Taiwanese names and species may be highly relevant to the Himalayan fern flora. The types of Taiwanese species are mostly in Japanese herbaria (Serizawa in TNS, Kurata in TOFO, Hayata in TI, and Tagawa in KYO). There is a connection too between the Himalaya and Japan, though markedly smaller than that with Taiwan, see Hirabayashi (1974), for example, and Nakaike's excellent and generally highly accurate *Enumeratio pteridophytarum japonicarum* (1975) and, for quick reference, Tagawa (1963) and Kurata & Nakaike (1979).

Another spate of work began on the north-eastern borders of the Indian subcontinent, in China, in the first quarter of the present century with the collections of C. Schneider and H. Handel-Mazzetti of Wien (specimens at W), Dr H. Smith of Uppsala (specimens in BM, PE, US and UPS), Dr J. F. Rock (including the north-east border of Burma) (specimens at K, BM, and US) and G. Forrest (specimens at E), up until the 1930s; and within the subcontinent, those of F. Kingdon-Ward (specimens at BM) from east Tibet, Assam, and north Burma between 1924 and 1949 and, more importantly for ferns, those of R. E. Cooper (specimens at E) in Bhutan in 1914, Dr N. L. Bor (specimens at BM, K, CAL and DD) in Assam from 1931–1936 and particularly those of F. Ludlow, G. Sherriff and G. Taylor (see Fletcher, 1976, and Stearn, 1976) and others

who joined with them in Bhutan, Assam, and east Tibet (specimens at BM), whose excellent collections, including many ferns, were made from 1933 until 1950, shortly after the closure to foreigners of Tibet in 1947. All these areas are almost completely inaccessible today for political reasons, though some brief collecting was also done in Bhutan between 1963 and 1965 by the Botanical Survey of India (see Deb, Sen Gupta & Malick, 1968). In particular the fern flora of north Burma, which is probably among the richest of the whole area, is very little known and badly undercollected and the area cannot now be visited; only Rock, Kingdon-Ward and Dickason have collected there to any extent, and in comparison with other areas their collections were limited. The closure of the east however was partly compensated for by the opening up of Nepal to foreigners in 1949 and the subsequent large collections of O. Polunin, J. D. A. Stainton, W. R. Sykes and L. H. J. Williams (specimens at BM), albeit with very brief information about localities that therefore take much finding, and of A. H. G. Alston, C. E. B. Bonner and A. Zimmerman (specimens at BM and G). Capt. Lall Dhwoj also collected in Nepal as early as 1927 and deposited specimens at BM. A considerable number of smaller collections, such as those of J. F. Dobremez (University of Grenoble), H. Emery, Foster and E. W. Cronin, from the Arun valley (American Peace Corps), T. Wraber (University of Ljubljana) and many others, have been made in recent years, though most of the interesting part of the Himalayan main range in west and east Nepal is now restricted again for foreigners, but this is partly compensated for by the excellent new work of Nepalese botanists (see below). The Nepalese collections began to open up large areas in the middle of the Himalaya that had been almost blank, at least since Wallich's rather restricted collection in south-central Nepal in 1820, so that material became available which now allows the full ranges of species to be understood. Rather little work has been done at Kew on the area over the last fifty years, except for Professor R. E. Holttum's outstanding and comprehensive studies of thelypteroid ferns (1969–1979), along with some identification of submitted material. A. H. G. Alston at the British Museum (Natural History) was able to identify much of the material sent from the area, if somewhat inaccurately in critical genera, but nevertheless covering a wide spectrum and with a comprehensive knowledge of the literature, which enabled him to identify incoming material and inform the new schools of local botanists in India up until the time of his death in 1958.

The first active fern-worker in India, after a gap of some time, was the American botanist, Dr R. R. Stewart, Principal of Gordon College, Rawalpindi, now Pakistan (specimens at the National Herbarium, Islamabad (RAW), BM, and at Ann Arbor (MICH), Michigan, US and PE), who built up a large collection of west Himalayan ferns, mainly from Pakistan and Kashmir, areas that had been largely ignored beforehand. He also purchased the important Trotter herbarium which, together with his own extensive collections, forms the basis of the National Herbarium, Islamabad, formerly at Gordon College. He communicated with Alston in London and published several useful papers on the area (Stewart, 1942, 1945, 1951, 1952, 1957, 1977). Before he retired to Ann Arbor, Michigan, U.S.A., in 1960, where he is still actively working, he inspired a generation of local botanists whom he had taught at Gordon College, and others whom he influenced elsewhere.

Another worker with whom Stewart had considerable contact was Professor P. N. Mehra of the Punjab University, Lahore (formerly a co-worker of Professor S. R. Kashyap), who later moved to Amritsar as a result of the partition of India and Pakistan in 1947, and then founded the botany department of the new Panjab University at Chandigarh. Professor Mehra is undoubtedly a founding figure in modern Indian botany and under his remarkable direction the Panjab University probably became the most active school of botany in the subcontinent. During the last forty years many of his students, including those who, since partition in 1947, moved to new centres in India, have worked on the ferns of their own country with small monographic papers and local or regional, annotated lists. Under Mehra's influence, the new generation of local botanists has seen the revolution in botanical studies resulting from the arrival of the new cytological approach pioneered by the work on ferns of Manton (1950, etc.). In addition to more traditional botanical studies, which, it must be emphasised, are still every bit as important now as before, Mehra was able to introduce some of the impact of the modern cytological approach and some of the results of systematic studies into fern-work in the Indian

subcontinent. A large number of preliminary cytological reports have been published and an increasing number of botanical publications are being produced from the increasing universities and institutes there, including the nation-wide offices of the Botanical Survey of India, with its headquarters at Calcutta. Among others, some of the more active centres in the subcontinent, with herbaria and with their staff producing work relevant to these monographs, are as follows:

In Pakistan:

The Pakistan Forest Institute, Peshawar (PPFI), where Dr A. R. Beg (an ex-student of Stewart), and others are working.

The University of Karachi (KUH), where Professor S. I. Ali (an ex-student of Stewart) is working with Professor E. Nasir on the excellent emergent *Flora of West Pakistan* (Nasir & Ali (eds) 1970–79 and in prep.) which will probably include ferns. There is unfortunately no such corresponding 'Flora of India', though it is at present being discussed and planned by the Botanical Survey of India hopefully drawing on the expertise of authors world-wide, group by group, and would be a much more major undertaking.

The National Herbarium and Stewart Collection, Islamabad (RAW), where Professor E. Nasir (an ex-student of Stewart) is co-editing the *Flora of West Pakistan* and has set up a small but highly competent botanical institute.

There is also a new Quaid-i-Azam University herbarium (ISL) at Islamabad, which has produced a new journal (*Pakistan systematics* (1977– etc.)) and needs further encouragement and advice, having built up a useful collection rapidly. It is to be hoped that their work will develop and continue.

In India, the main establishments which are important for fern study are as follows:

The Jammu and Kashmiri University, Srinagar (KASH), where Professor P. Kachroo has worked on ferns.

The Panjab University, Chandigarh (PAN), where Professor P. N. Mehra, retired, has carried out much fern work, and from where Professor S. C. Verma and Professor D. S. Loyal (both ex-students of Mehra) have published numerous papers. The next generation of active fern workers there, who also graduated under Mehra, are Dr S. P. Khullar, Dr K. K. Dhir and Dr H. S. Puri.

The Punjabi University, Patiala (PUN), where Professor S. S. Bir (an ex-student of Mehra), previously at Chandigarh, has published and edited a large amount of important taxonomic fern literature.

The Forest Research Institute, Dehra Dun (DD), which has what is probably the finest fern-herbarium in the subcontinent with many important, old collections, including those from the Saharanpur herbarium, containing isotypes etc. from Clarke, Hope, Blanford and others, and where Dr K. M. Vaid (an ex-student of Stewart) has published on ferns.

The University of Delhi (DUH), with Dr N. P. Chowdhury, who has worked on ferns.

The University of Poona, where Professor T. S. Mahabale, retired (now of the Maharashtra Association for the Cultivation of Science-Research Institute) and others have studied the anatomy of certain groups of ferns.

The National Botanical Research Institute and Gardens, Lucknow (LWG), most actively run by Dr T. N. Koshoo with, among other active workers, Dr S. Kaur who has worked on ferns.

The Benares Hindu University, Varanasi (BAN), with Dr S. K. Roy, who studied under Professor Manton at Leeds, and Dr J. B. Singh, who have worked on ferns.

The University of Patna, with Professor R. P. Roy and Dr B. M. B. Sinha, who have worked on ferns, including those from Nepal.

The University of Kalyani, Kalyani, Nadia, West Bengal where Drs U. Sen and T. Sen have worked on fern anatomy.

The Central National Herbarium of the Botanical Survey of India (CAL), at Howrah, Calcutta, where Dr G. Panigrahi (who studied briefly under Manton at Leeds), Dr A. S. Rao, Dr K. Nag, and others have worked on ferns. This herbarium is an important one with many old collections, though unfortunately recent local workers have sometimes taken it upon themselves to cross out the more accurate and important identifications of the original collectors, and many sheets can be found which have had their original labels cut in half or even cut off altogether in order to fit them on to the new, smaller-sized sheets now in use. Some skilful interpretation may therefore be necessary on occasions, and some specimens may have been rendered useless. The regional offices of the B.S.I. are at Dehra Dun (BSD), Coimbatore (MH), Shillong (ASSAM), Jodhpur (BSJ), (with B. V. Shetty, Malhotra and R. P. Pandey, who have worked on ferns), Poona (BSI), and Allahabad (BSA).

The University of Calcutta (CUH), where Drs S. & N. Pal have worked on ferns.

The Jawarharlal Nehru University, Imphal, Manipur, where Dr J. Ghatak, formerly of CAL, who studied under Manton at Leeds, has worked on ferns.

The University of Bangalore, where Dr S. N. Agashe has published on ferns.

The University of Kerala, Trivandrum, where Drs A. Abraham, K. V. Bhavanandan, C. N. Ninan, and P. N. Matthew have worked on ferns and on the cytology of south Indian species.

The Botanical Survey of India, Southern Circle (MH), at Coimbatore, including what little remains of the Old Madras Herbarium, with Dr N. C. Nair, who has worked on ferns.

The University of Calicut, where Professor B. K. Nayar and Dr K. K. Geevarghese have worked on ferns.

In Sri Lanka:

The National Herbarium and Botanic Garden, Peradeniya, Sri Lanka (PDA), which contains an important collection of Sri Lankan specimens, including many older collections by Thwaites, Trimen, etc., with Catalogue Peradeniya (C.P.) numbers, and which are frequently type material.

Numerous other Indian workers have worked on pteridophyte genera not relevant to the present study. Many of the publications from the research workers mentioned above are the only modern ones available for numerous genera and the lack of a fern flora of larger scope is keenly felt. Unfortunately it is necessary to point out that much modern Indian work suffers badly from numerous misidentifications, and there is a noticeable tendency to redescribe species already known under earlier names. This is partly due to inability to obtain funds to examine the important type specimens, which as a result of history are almost all in Europe, and mostly at Kew and BM in Britain. Indeed the situation concerning lack of typification is so serious that few Indian publications can be fully relied upon. A useful code of practice might well be not to publish, where typification is important, until the genuine, correct type or a photograph of it has been seen, as it is clear that in many ways it is better not to publish at all than to cause even greater confusion merely because that most essential part of the work has not been carried out. There is also too much local institute or university political pressure concerning promotion prospects, etc., at present, to publish too frequently, and often a great deal of rivalry with little communication between workers, or even the unauthorised taking over of work done by others, from determinations made in herbaria, etc., which has caused the quality and aim or purpose of work to suffer. Other noticeable problems are the poor herbarium specimens which are all too often fragments, or lack stipe scales, or are twisted and folded up and brown, the untraceably brief localities, the lack of numbering with identifiable cytological and other voucher specimens (where each plant should be numbered separately and the numbers cited to back up each cytological result), or vouchers with unripe spores, often due to cytological fixation being carried out only in the field, rather than culturing plants to subsequent spore maturity. Some of the problems with collecting are caused by the use of newspaper without flimsy papers and without proper drying paper, and local botanists all too frequently concentrate on a few well-known, low-level areas, even avoiding many of the far more interesting high-level areas that have roads leading to them, and thus are often unaware of the many extra species occurring higher up, even though they may have been clearly recorded in the past. Unfortunately private transport is not generally available as it is in Europe, but more useful and constructive programmes for the use of institute vehicles could easily be planned to allow improvements and to increase their workers' topographical knowledge of a wider area of the Himalaya. It is to be hoped that these 'teething-troubles' in Indian work will eventually be eliminated, and especially that cytological studies will go further than mere lists of chromosome counts; the development of a few small gardens for the culture of Himalayan species at such amenable places as Simla and other hill stations would allow experimental research, which is sadly lacking at present merely because high-level species cannot be cultivated on the plains where the main institutes are based. For comparison, and as a guide to what has been done in this field, an excellent summary of the results gained from more far-reaching recent studies in Europe and North America, much of it relevant too to the Indian subcontinent, is to be found in Lovis (1977), as well as in Manton (1950). Both of these workers were at Leeds University, though Professor Lovis is now at the University of Canterbury, New Zealand.

The advent of the Japanese botanists into the area with the *Flora of the east Himalayas* reports (Itô, Tagawa, Nishida & Iwatsuki, 1966; Itô, Tagawa, Nishida & Iwatsuki, 1971; Iwatsuki, 1975) has added a number of new records from their collecting excursions. However, the first two

reports have also included a considerable number of misidentifications in the ferns due to lack of typification, with some redescription of previously known species, and erroneous records of east Asian and Taiwanese taxa in error for comparatively well-known Himalayan species. These are fortunately mostly corrected in the much more reliable third report. Their collections (in Tokyo (TI), with duplicates in KATH, BM, and K, etc.) have clearly been of a high quality and are of considerable use, often including new records of rare species due to their energy in collecting from remote places at considerable altitudes, which have usually not been visited by Indian botanists.

In Nepal, a new and active school of botanists has arisen, with a herbarium at Godavari belonging to His Majesty's Government, Department of Medicinal Plants and Herbs, Kathmandu (KATH), which has produced preliminary fern-work of a good standard (see Gurung, 1974, 1976*a*, 1976*b*, and in press). The herbarium contains a large number of excellent specimens, albeit rather poorly identified (based mainly on the earlier Japanese expeditions' determinations and those done by the Botanical Survey of India, Calcutta), and the range of their collecting excursions into remote parts of the high Himalaya, accessible only by trekking, is a fine example to other workers in the subcontinent. Other work has been carried out by Dr A. R. Sakya of the Botany Department, University of Kathmandu (see Roy, Sinha & Sakya, 1971).

A considerable amount of collecting of Nepalese ferns was also carried out by the American worker, Dr R. L. Fleming senior, of the United Mission to Nepal, and of Woodstock School, Mussoorie, N. India, who has recently (in 1980) retired to Phoenix, Arizona, U.S.A., and has worked with Dr R. R. Stewart and with the Nepalese botanists. His specimens are at Kew, BM, Dehra Dun (DD), Ann Arbor (MICH), and Kathmandu (KATH).

It is unfortunate that restrictions exist once more in all the interesting western and eastern parts of the Himalayan main range in Nepal so that the furthest east that foreign workers may visit in all the Himalaya, apart from south-east Nepal, the Darjeeling area, and S.W. Sikkim, is the upper Arun valley east of the Everest range. The east Himalayan ranges are thus closed to the bulk of botanical specialists and collectors, including local botanists in all the far eastern part.

Some important work by British botanists on the fern flora of Sri Lanka (Ceylon) in recent years has been carried out by Professor I. Manton and Dr W. A. Sledge of Leeds University, including also detailed cytological studies on the genus *Adiantum* throughout India (Manton, Ghatak & Sinha, 1967; Manton, Sinha & Vida, 1970; Sinha & Manton, 1970), and surveys of the cytology of Sri Lankan ferns (Manton, 1953; Manton & Sledge, 1974). Sledge has produced a fine series of considerably detailed papers or monographs of fern genera in Sri Lanka (Sledge, 1960, 1962, 1965, 1973, 1981, 1982) and, while unfamiliarity with related Himalayan species is sometimes noticeable and has caused some inaccuracies, his work is of remarkable scope and fundamental importance for the area.

Recent major work on the Indian subcontinent flora includes Hara, Stearn & Williams (1978), Hara & Williams (1979), and Hara, Chater & Williams (1982) working on the Nepalese flora at the British Museum (Natural History), London, but excluding ferns, and Grierson & Long (in preparation) working on the *Flora of Bhutan* at Edinburgh, under the sponsorship of the Royal Bhutanese Government and Overseas Development Aid, and including a brief account of the better-known ferns. A detailed account of the ferns and fern-allies of Pakistan west of the Indus, Afghanistan, and Iran, is also in preparation by Fraser-Jenkins, Khullar & Reichstein (in preparation) for Professor K. H. Rechinger's far-reaching series *Flora iranica*, nearing completion from Wien, Austria.

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Geography

Floristic considerations

The three genera *Athyrium, Dryopteris,* and *Polystichum* are all predominantly temperate, probably with their main evolutionary centres in south-west China where by far the maximum number of species occur today. *Dryopteris* and *Polystichum* have some apparent secondary areas of evolution in Europe (based on the Caucasus and Atlantic regions), East Africa, North America, the Far East (Japan and Taiwan) and south-east Asia. In *Dryopteris* only a few of its approximately 215 species, mainly the south-east Asian element, are subtropical or tropical in ecology and distribution. *Polystichum* however has a far larger number of lowland tropical or subtropical species occurring in south-east Asia, Australasia (where *Dryopteris* is restricted to a very few species) Africa, and South America, in addition to the large number of species occurring in all the temperate regions of the world. It is therefore a more cosmopolitan genus. It is worth mentioning here that the genus *Arachniodes*, with apparent relationships to *Polystichum*, is predominantly sub-tropical. *Athyrium* by contrast has only two representatives in the European type flora, several more in North America and Africa, and is absent from South America and Australia. Its main centre of distribution is in eastern Asia, particularly in west China and Taiwan, and in Japan, with a number of species occurring in south-east Asia. Related genera such as *Lunathyrium, Dryoathyrium,* etc., are generally similarly distributed.

These genera in the Indian subcontinent contain species whose distribution patterns show that they represent a number of different floristic or geographical elements within the flora. But the ecology of all the species makes them temperate or subtemperate mesophytic plants, so that they only show more or less temperate mesophytic distribution types, and do not show any of the rather more common patterns, including those of tropical plants or xeromorphs, etc., that are frequent in the Indian subcontinent. The bulk of species represent the deciduous or coniferous forest elements of the extra-tropical humid ecological type of Meusel (1971), and occur or frequently have close relations further east in south-west China, etc., and east to Taiwan. The greatest number of species occurs in the highly oceanic eastern parts of the Himalaya, where the summer monsoon (June–September) from the Bay of Bengal and Indian Ocean has its greatest effect, and there are also fairly frequent winter rains. The mountains of southern India and Sri Lanka, affected strongly by both a summer and winter monsoon, also contain some of these elements, though they have a relatively greater proportion of species with south-east Asian affinities. Other elements are also present in the Himalaya, some are probably sub-types which have specialised from the extra-tropical humid type, but there is also a small temperate European element in the drier west Himalaya. Most of these distribution types correspond with one of the ten different patterns described by Stearn (1960). The three genera concerned are absent from the low-lying parts of the plains of India, Pakistan, and Bangladesh.

The different phytogeographical types may be summarised as follows:

1. Sino–Himalayan species

These are species found in south and south-west China, south-east Tibet and the forest zones of the Himalaya. Outside this area they often occur somewhat disjunctly in Taiwan (though several

species have in the past been thought not to be present across south China, but are only now known to occur on mountains in scattered localities bridging the gap between Yunnan and Taiwan) and sometimes as far east as the Philippines, and occasionally Japan too (see Kanai, 1963). Some species may also have more distant and ancient European or East African relationships – for example, *Athyrium attenuatum* (C. B. Clarke) Tag. to *A. filix-femina* (L.) Roth of Europe (See Fraser-Jenkins & Khullar (1982)); *Polystichum piceo-paleaceum* Tag. and other species of the *P. yunnanense* Christ and *P. makinoi* (Tag.) Tag. agg. to *P. fusco-paleaceum* Alston of East Africa and to *P. setiferum* (Forsskal) Woynar of Europe; *P. luctuosum* (Kunze) T. Moore present in the west Himalaya and East and South Africa (and the almost certainly synonymous *P. tsus-simense* (Hook.) J. Smith in China and the Far East). Within this major group certain more-or-less distinct geographical sub-types occur, though these are really based on a difference of degree of ecological tolerance and adaptations concerning oceanicity, altitude, drought, etc., so that intermediates may occur. It should be noted though that there is also a marked gradation effect depending on depth into the Himalayan range (i.e. outer versus inner ranges), which markedly affects the rainfall and thus their distribution (as discussed by Schweinfurth (1957) and later authors). These sub-types are:

(i) Widespread Sino–Himalayan species:

Some species in this group may not be common to both west China and the Indian side of the Himalaya, but most of the widespread species are, and there is a particularly marked similarity between the fern flora of most of Yunnan and south-west China and that of the eastern part of the central Himalaya and of the east Himalaya. The widespread species have somewhat oceanic requirements and occur in the high rainfall areas maintained by the summer monsoon. In the Indian subcontinent they are common in the central and east Himalaya, and are also quite frequent in Kumaon in the eastern part of the west Himalaya, though here often only in the first major ranges of hills north from the plains (i.e. the outermost ranges), which receive the highest rainfall and contain the thickest forest, providing they are high enough for the species concerned. From here they often have scattered extensions westwards in the outermost ranges at mid-levels, commonly as far as Chamba, but even, via the Pir Panjal Range, up to Kashmir, the eastern part of Pakistan, or west of the Indus. Examples include *Athyrium attenuatum* (C. B. Clarke) Tag. (west China to Yunnan and throughout the Indo–Himalaya to Afghanistan), *Polystichum squarrosum* (D. Don) Fée (south-east Tibet and Assam, west to Pakistan east of the Indus; also in south India), *P. obliquum* (D. Don) T. Moore (south-west China, west to Chamba), and *Dryopteris stenolepis* (Baker) Christensen (south mainland China, Taiwan, south-east Tibet, North Vietnam, etc., and west to Tehri Garhwal in the eastern part of the west Himalaya).

(ii) East Himalayan west Chinese species:

These are markedly oceanic in requirements and may be defined as not occurring west of the central Himalaya (i.e. Nepal) and generally only as far west as central Nepal. With more oceanic genera, such as *Rhododendron*, the dividing lines between west and east Himalayan species are slightly further east. Their westward range may be limited by the length and intensity of the dry period between the monsoons; the monsoon beginning earlier and ending later in the east Himalaya, and pre-monsoon spring rains being more frequent there (see Stainton (1972)). Examples include *Dryopteris marginata* (Wallich ex Clarke) Christ (Taiwan and from mainland south China to the Kathmandu valley in central Nepal; western records refer to *D. carolo-hopei* Fraser-Jenkins) and *Polystichum acutidens* Christ (south and south-west China and west in the east Himalaya to the Sikkim area).

(iii) West Himalayan species:

These are often endemic to the west Himalaya and have presumably become adapted to the rather drier conditions present in the forests of the west Himalaya, seldom occurring east of west Nepal and uncommon this far east. Several of them cross over and occur behind the Himalayan line in places in south and south-east Tibet (north of east Nepal, Sikkim, Bhutan, etc.) where some of the valleys pass through the main range allowing somewhat greater rainfall unlike the

situation in the central and west Himalaya, so that these west Himalayan elements may continue eastwards as scattered populations in south and south-east Tibet and reach a second area of distribution in south-west China. This is presumably due to the medium dry conditions in a few scattered areas in a narrow belt behind the Himalayan line being similar to those in the west Himalaya; a few such areas also occur in Bhutan (Stainton, 1972) and may also be expected to contain some of these species. A similar situation has also been noticed in some species of the genus *Allium* by Stearn (1960), and Stainton (1972) discusses this phenomenon in some detail, with other examples from several genera. Some of the species may have close relations or apparent bicentric occurrences east of the Himalaya, probably due to extinction of the linking populations either by excessive dryness, or altitude in Tibet, or excessive oceanicity in the east Himalaya. The close juxtaposition of these two limiting factors in the central and east Himalaya appears to have been the cause of their obliteration in the area between the two zones of occurrence. The links between the two populations probably existed at the time when the Tibetan flora had not been mainly extinguished due to rain shadow caused by the tertiary uplift of the Himalayan ranges (see Ching & Wu, 1980); however, there is as yet little definite evidence that the Himalayan uplift was actually the cause of the drying up of Tibet, which could in fact be part of a general change in atmospheric patterns which has led to world-wide desert formation. As far as *Dryopteris, Polystichum,* and *Athyrium* are concerned, the west Himalayan species are, from their relationships to other species, part of the Sino–Himalayan element even when they do not occur in China. Examples include *Dryopteris ramosa* (Hope) Christensen (Afghanistan to west Nepal; perhaps distantly related to the north and east Chinese, Siberian, and Japanese *D. goeringiana* (Kunze) Koidz, and the Japanese *D. shiroumensis* Kurata & Nakaike), *D. blanfordii* (Hope) Christensen (Afghanistan to Pithoragarh in the eastern part of the west Himalaya, but apparently with a second and disjunct centre in south-east Tibet and west China, as subsp. *nigrosquamosa* (Ching) Fraser-Jenkins, in similar ecological conditions), *Polystichum luctuosum* (Kunze) T. Moore (South and East Africa, the Himalaya from Pakistan west of the Indus to west Nepal, with the probably synonymous *P. tsus-simense* (Hook.) J. Smith occurring again in south-east Tibet, south, central, and east China (including Taiwan), and Japan).

(iv) Tibetan species:

These are high altitude plants adapted to extremes of drought and cold, occurring in Tibet and the higher, inner ranges of the Himalaya, often north of (behind) the Himalayan line, which is the line beyond which the forests do not occur on the approaches to Tibet due to rain-shadow (see Stainton, 1972). Examples include *Polystichum glaciale* Christ (west Bhutan, Tibet, and high mountains in Yunnan and Szechuan) and *Athyrium davidii* (Franchet) Christ (= *A. duthiei* Bedd.) (north Chamoli to Bhutan, south Tibet, Yunnan, and Szechuan).

2. European species

These have been referred to by some authors (e.g. Clarke, 1898; Fedtchenko, 1903–1947; Mani, 1978) as part of the central-Asian or middle-Asian component, occurring in the Pamirs, Tien Shan, etc. Undoubtedly this is partly correct but their 'central-Asian relationships' are also, in part, due to a continuing tendency for Russian botanists, somewhat isolated from elsewhere, to think in local terms and refer to species as endemics when they are not. Because ferns are mesophytes, almost the only species that have reached the Himalaya and those parts of central Asia from anywhere other than the east and south, are a few widespread European species with a greater measure of drought tolerance and robustness than usual, thus enabling them to cross the desert gap of Iran, Afghanistan, and Kazakhstan, presumably before it became quite as dry as it is at present. There is only a very small Soviet–central-Asian fern component, and it has not penetrated the Himalaya and is probably of comparatively recent tertiary European origin. Hence as far as ferns are concerned, the 'middle-Asian-component' may be more correctly referred to as the European element. Almost all the European species in the Himalaya are confined to the west Himalaya, being limited by the heat, or by the humid, subtropical, or temperate, forest zone which allows excessive competition to these species further east, or by

the cold and harshness of the upper Tibetan zone. The west Himalaya are also affected by considerably more winter rain or snowfall (and thus spring melt) than further east, somewhat more like the European region (see Stainton, 1972). In the west Himalaya the European species occupy either a Mediterranean-type belt at lower levels (e.g. in *Cheilanthes*), or a mid- to high-level belt between the Tibetan and forest zones (e.g. in *Asplenium* and the examples below). Examples include the only two European species in the genera *Polystichum, Dryopteris,* and *Athyrium*: *Polystichum lonchitis* (L.) Roth (Afghanistan to east Kashmir, also the Tien Shan, Altai, western Asia, Europe, Siberia, Far-East, Japan, and North America) and *Dryopteris filix-mas* (L.) Schott (Afghanistan to south Baltistan, also the Pamirs, Kazakhstan, Tien-Shan, Altai, west Siberia, Dzhungaria, western Asia, Europe, north-west Africa, North and South America).

3. South-east Asian species

These are an important element in the fern-flora of Sri Lanka and southern India, extending up the mountain ranges in places in central India to the Himalaya, where they behave like widespread Sino–Himalayan species in the forest zone, but at rather low levels. They are present in Malaysia, Thailand, Indo–China, the islands of south-east Asia, the Philippines, northern Australia, and often southern Japan. The species present in the Indian subcontinent appear to have a wide ecological tolerance and therefore cover a wide area. Some of the Sri Lankan and south Indian species may not be south-east Asian species, but endemics, with their closest relations being south-east Asian elements. *Dryopteris deparioides* (T. Moore) Kunze and other species allied to *D. sparsa* (Buch.-Ham. ex D. Don) Kunze are examples. True south-east Asian species include *Polystichum subapiciflorum* Hayata from central Nepal east to north Assam, Khasia, Burma, Thailand, North Vietnam, south China including Taiwan, which is allied to *P. biaristatum* (Blume) T. Moore of south-east Asia and Sri Lanka, *Dryopteris sparsa* Buch.-Ham. ex D. Don) Kuntze (south-east Asia, northern Australia and Australian islands, south-east Tibet, south China, Taiwan, the Philippines, south Japan, Sri Lanka, south India, mountains of central India, Assam, the Himalaya from south-east Tibet and Assam west to the Simla region, though rare west of Nepal), *D. cochleata* (Ham. ex D. Don) Christensen. (South-east Asia, south-east Tibet, south China, the Philippines, south India, mountains of central India, the Himalaya west to Chamba), *D. hirtipes* (Blume) Kuntze and subspecies (south-east Asia, Sri Lanka, south India, the east Himalaya including south-east Tibet and Yunnan, south-east China, Japan, the Philippines and New Hebrides), *Athyrium nigripes* (Blume) T. Moore (south-east Asia, Sri Lanka, south India, south-east Tibet, Yunnan, the Himalaya west to Tehri Garhwal), and *Polystichum biaristatum* (Blume) T. Moore (south-east Asia and Sri Lanka).

4. Cosmopolitan species

One species, *Dryopteris wallichiana* (Sprengel) N. Hylander, is probably worthy of a separate phytogeographical category, though it may also be considered a sub-group of the Sino–Himalayan species. Its origins appear to have been in west China and the east Himalaya, though from its wide distribution and relationships elsewhere it must be ancient, with polyploid apomictic pillar complexes built up from it in various parts of the world, including the *D. affinis* group in Europe (see Fraser-Jenkins, 1980). *D. wallichiana* is distributed in subtropical regions, in Central- and South-America, the West Indies, southern Atlantic Islands, south-east Africa, Madagascar, the Indian subcontinent (the Himalaya, with a related species in south India and Sri Lanka), south-east Asia (with related species), south-west, south, and south-east China (including Taiwan), the Philippines, Japan, and Hawaii (with related species).

Geographical limits and major phytogeographic divisions within India

The area included in this study consists of east Afghanistan, Pakistan, India, Nepal, Sikkim (India), Chumbi in south Tibet (China), Bhutan, Assam (India), Bangladesh, and Sri Lanka (Ceylon), which forms the Indian subcontinent. The western limit to the Indian (part of the

Sino–Himalayan) fern flora is defined naturally by the line beyond which the influence of the summer monsoon is no longer felt, which passes through south-western Pakistan and then through Afghanistan approximately level with the high middle of the Hindu Kush and including the wetter north-eastern region, Nuristan (previously known as Kafiristan), before running northwards to the border of the U.S.S.R. on the Oxus (Amu Darya), south of Dushanbe. Beyond the line, to the west, the harsh and dry desert climate of western Afghanistan, Kazakhstan, and most of Iran forms a large natural gap between the Sino–Himalayan fern flora and the European-type fern flora. The latter reaches its south-eastern limit in the eastern Elburz mountains of north-eastern Iran shortly east of the Caspian Sea, along the southern shores of which a narrow belt of forest extends eastward from Transcaucasia. The European flora also passes east through the Russian to the Chinese Tien Shan (with some species present in the Pamirs), west Siberia and the Altai to Irkutsk, where it gives way to the Far-Eastern fern flora. Few species of ferns have been able to cross the gap from west to east into the Himalaya, or in the other direction, apart from *Dryopteris barbigera* subsp. *komarovii* (Kossinsky) Fraser-Jenkins, which reaches the Pamirs and Tien-Shan in the U.S.S.R. and China, and *Polystichum wilsonii* Christ and *P. lachenense* (Hook.) Bedd. which reach as far west as the Chinese Tien Shan south of Urumchi. In the early tertiary period, though, several species of flowering plants migrated from the Indian subcontinent towards Europe (see Meusel, 1971), and probably one or two ferns, such as the ancestors of *Dryopteris wallichiana* (Sprengel) N. Hylander, from which the European *D. affinis* (Lowe) Fraser-Jenkins appears to have been derived (see Fraser-Jenkins, 1980). During the late tertiary the area between the Himalaya and the Caspian dried up almost completely, including what was once a large shallow sea north of the Elburz and West Pamirs, now represented only by the Caspian and Aral Seas. To the north-west of the Indian subcontinent the great masses of the Pamirs and Karakoram have also formed a natural boundary to the flora, reinforced by the desert areas of Kazakhstan and the Sinkiang to the north. This barrier extends all along the north of the area, north of the Himalayan line, as the extensive cold desert highlands of western and central Tibet, extending more or less as far east as the region north of the Tsangpo, north of Sikkim on the western edge of the east Himalaya, so that the western and most of the northern limits of the flora are clear and natural.

In the east Himalaya the Indian subcontinent flora joins up with that from the more equable south-eastern Tibet and western-China, with few barriers. The Himalayan ranges are slightly less high there and are penetrated by several deep valleys which allow them to be wet on the Chinese and Burmese sides as well, where they come to an end in the east, the moisture probably being due mainly to the far- reaching effects of the summer monsoon that turns east-north-eastwards from the Bay of Bengal. The continuity of the east Himalayan and west Chinese flora indicate the possible Chinese origin of many of the Sino–Himalayan ferns, the flora apparently being much richer on the Chinese side. The rich flora of western Yunnan (and perhaps also north Burma, though this area is too little known at present), constituting the centre of distribution of many temperate genera, may well be due partly to the fact that the mountain ranges there (constantly causing a moist climate at their edges) run north to south rather than east to west as in the Himalaya proper. Thus as the climate cooled or warmed up they did not constitute a barrier, but acted as a route for north and southward migration (and also allowed altitudinal migration) of species, so that fewer were extinguished. A similar situation exists when comparing the flora of Europe (with the horizontal Pyrenees, Alps, Carpathians, Balkans, Pontic, Caucasian, and Elburz line) to that of North America (with its vertical Rockies, or Appalachian lines). In several species their range extends eastwards well beyond the Indian subcontinent to south China, including Taiwan and, to a lesser extent, to southern and central Japan. The eastern and north-eastern boundary to this study is therefore artificial and is dictated mostly by political and historical considerations, confining it to the Indian subcontinent and excluding north Burma, China, and Tibet; the high peaks of the eastern part of the great Himalayan range and the mountainous eastern border of Assam represent a boundary of convenience. Knowledge of what happens to the fern-flora in montane Assam (except in Khasia and, to a certain extent, Manipur) and north Burma is necessarily vague due to the political impossibility of even local botanists collecting in that little-known and perhaps somewhat

dangerous region; hence the importance of such collections as those of Ludlow and Sherriff, and Kingdon-Ward, who were able to visit the far east Himalaya this century.

South of the Himalaya and Assam there are rather few ferns present in temperate genera, except in the mountains of the south-Indian peninsula and in Sri Lanka. Due to the low altitude and somewhat arid climate, the flora of the plains of central India is predominantly of a tropical semi-arid type (Meusel, 1971) and excludes most species belonging to temperate or mesophytic genera, except for a few subtropical ferns mostly representing south-east Asian elements, which occur on the isolated low mountain ranges of Hindustan (central India). Sri Lanka and the southern part of India were included in this study partly because they complete a political unit, and because, although it is not very large, there is nevertheless a noticeable floristic connection between the north and south, probably as strong as or stronger than those between the south and any other areas. The low hills of central-India may well have acted as stepping-stones in a connecting land-bridge between the Himalaya and the south at some stages in the past (see Burkill, 1924–25; Gupta, 1962, Bir & Vasudeva, 1973).

Within the Indian subcontinent four major floristic and geographical divisions are recognised:

1. The Himalaya

The Himalaya contains by far the richest flora and is the most important area for the present study. As will already have been noticed, it has been geographically divided, following Hooker (1904), Chatterjee (1940), and some later authors, into the west, central, and east Himalaya. This division is both natural and convenient, considering the fact that the total length of the Himalaya is approximately two thousand miles in a diagonal curve from the north-west to the south-east, covering over 30° of longitude and also, importantly, some 10° of latitude (though only some 250 km wide) and grading from the drier climate in the north-west to the wetter conditions in the south-east. It is also reflected in the distribution patterns of species, including those within the genera concerned, though this is not a case of hard-and-fast boundaries between the three areas, but rather a gradation as might be expected. But there is a considerable change-over of species occurring in about the region from East Kumaon (west of Nepal) to near Jumla in west Nepal; the actual boundary between the west and central Himalaya being fixed for reasons of convenience at the western Nepalese border. It is only since the opening up of Nepal to foreign botanists in 1949 that the position of this boundary could be clarified. The boundary between the central and east Himalaya on the other hand is often not yet completely clear except for certain flowering plant genera (e.g. *Primula*, *Rhododendron*, *Lilium*) which, due to their horticultural value, attracted considerable attention at an early date; more access to the east Himalaya will have to be gained before it can be placed with accuracy. But for historical and political reasons this has been placed at the eastern border of Nepal; Sikkim and Darjeeling, which have been accessible for a considerable time until recently, being considered to be in the east Himalaya. This is mostly borne out by the genera *Dryopteris, Polystichum*, and *Athyrium,* though some of the east Himalayan species of *Dryopteris* may just extend to eastern Nepal (east of the Arun) and the lower altitude plants may even reach the Kathmandu valley. Thus Nepal and the term central Himalaya may be considered as synonymous, as first suggested by Chatterjee (1940). Further study is perhaps required to examine the validity of this usage in general, beyond the bounds of the present genera. It is also convenient and more-or-less natural to consider Khasia and Assam as part of the east Himalaya. It should be noted that Stearn (1960) did not use the term central Himalaya except in strictly geographical terms, as used here. However, its phytogeographical distinctness is as an area where certain species do *not* occur, rather than as a region with a distinct element of its own. Within the central Himalaya (Nepal), which may also be referred to as the Nepal Himalaya in order to show that the term is not a floristic one, various phytogeographical zones have been recognised. Mason (1933, 1955) delineated five natural regions, whilst Stainton (1972) independently recognised seven, mostly rather similar to those of Mason, and Dobremez (1972) condensed the zones into four. Though these zones are clearly natural and useful they are not used here, though they have influenced the present scheme of subdivision of Nepal into fifteen geographical areas; however for the

purposes of recording the distribution of species when spot-maps are at present impractical, at least in most parts of the Himalaya, the natural phytogeographical zones within Nepal are considerably too large. It should be noted that, for more general terms of reference, Stearn (1960) proposed a useful subdivision of Nepal into three zones: west, central, and east Nepal, bounded by the 83°E and 86° 30′E lines of longitude and based on the regions at which many flowering plant genera demonstrate the furthest points of distribution of their east Himalayan species towards the west (the 86° 30′ line) and of their west Himalayan species towards the east (the 83°E line). This scheme is now in general usage, though, again, it cannot be utilised here in the present more detailed context. As Stearn did not use the term central Himalaya phytogeographically (there being no such thing as a Central Himalayan species distribution pattern), he pointed out that the 83°E line, between west and central Nepal, is the approximate dividing line between the west and east Himalayan species, though this is not always strictly true in at least the present genera, where the higher altitude east Himalayan species usually reach only into the easternmost part of Nepal, or to Sikkim.

2. The plains of north and central India

The plains include the lowlands of Pakistan, the bulk of lowland India, and all of Bangladesh. They are of considerably less interest than the other areas as far as ferns are concerned, though they do contain, among others, the following low mountain ranges: Abu in Rajasthan, Pachmarhi and Balaghat in Madhya Pradesh, Hazaribagh in the former Chota Nagpur region of Madhya Pradesh and Bihar, and the interesting Parasnath Hill in Bihar. Some representatives of the genera concerned occur in all of these hills.

3. The south-Indian peninsula

South India is considered here to include the low-lying north-western and central-western Ghats, running through south Gujarat, Maharashtra, Karnataka, and north Kerala states; the similarly low north-eastern Ghats run through south Orissa, Madhya Pradesh and north-eastern Andhra Pradesh. Both of these extend down the peninsula of India along each coast and may have been important as land bridges in the past; they also contain a few representatives of the fern-genera concerned. Further south, in Kerala and Tamil Nadu (Madras) states are the high, wet, and fern-rich south-western Ghats (Nilgiris, Anamalai, and Palni Hills), the south- and central-eastern Ghats (including the moist and fern-rich Shevaroy Hills in Salem district), and the southern Ghats, near the tip of India. The higher mountains in these areas are of considerable interest, containing a large number of species, and being affected by both the summer and winter monsoons; they contain both Himalayan and Sri Lankan/south-east Asian species.

4. Sri Lanka

The island of Sri Lanka (Ceylon) shows floristic connections with south India, the Himalaya (in some cases with the Himalaya but not south India), and south-east Asia. It also contains in addition a rather high proportion of endemics, sometimes with related species in south-east Asia. For this, as well as for political reasons and because it is a large island, it is considered a separate major division. It contains an area of high mountains just south of the centre, and, like the southern part of south India, is affected by both summer and winter monsoons.

Distribution and mapping of species

The detailed distribution of ferns in the Indian subcontinent has scarcely been considered. The problems lie in part in the complex taxonomy of species in the large genera, and the misidentification that has so frequently occurred; the subcontinent also remains a little-studied area because much modern work has been in the nature of small, local, annotated lists, rather than a major flora of, for example, the Himalaya, or the whole of India. However, the

distribution patterns of species are of considerable interest and value, and a wealth of herbarium material exists, both in herbaria in the subcontinent and in Europe and the U.S.A., and may be drawn upon to produce maps, or descriptions of species distributions. Ideally, spot-maps could be produced which would show detailed distribution of species as well as under-collected areas. With this in mind I have compiled lists of all the specimens of *Dryopteris, Polystichum,* and *Athyrium* seen in many herbaria and it is hoped that before long a full-scale mapping project might come into being. In the meantime, in order to show the distribution of species, the subcontinent has been divided up here into many, quite small, numbered regions, the number of each area being listed under each species given in the taxonomic account (Fraser-Jenkins, 1985) when it occurs in that area. It is emphasised that only actual specimens seen and identified by the author have been considered for recording purposes, which is an advisable restriction. The literature, especially for the subcontinent, abounds with incorrect records in any critical genus; these may be useful for checking out possible new areas for a species, but are not to be relied upon until the specimen cited has been seen and identified. Hence the value of numbering each plant separately when collecting, and citing the specimen number when publishing new records. The numbered areas are based partly on geographical considerations, mountain groups, etc., and partly on named political regions, as so many of the older specimens are labelled only with the name of the region and modern collections are often too scarce from the less accessible areas. Altogether 100 regions have been recognised, as follows below (Fig. 1). The author hopes to publish detailed maps at a later stage.

1. HIMALAYA: *Afghanistan:* 1 Badakhshan. 2 Nuristan. 3 Wakhan. 4 Central Hindu Kush. 5 West Kurram and Paktai. 6 Zabul, Katawaz-Urgun, and Ghazni.
Pakistan: 7 Baluchistan (Kalat). 8 Quetta and Sulaiman Mts. 9 Waziristan, Bannu, and Dehra Ismail Khan. 10 East Kurram, Kohat, Tirah, and Khyber (this includes Aitchison's specimens from Kurram). 11 Peshawar and Mardan. 12 Malakand, Bajaur, and Dir. 13 Chitral and Yarkhun. 14 Kalam, Swat, and Buner. 15 Gilgit and Tribal Territory. 16 Hunza (Baltit). 17 Karakoram. 18 Deosai and Baltistan. 19 Chilas, Wazarat, and Burzil. 20 Hazara and Murree. 21 Muzaffarabad. 22 North-west Pir Panjal, Kotli, and Mirpur.
India: 23 Poonch and Riazi. 24 West Kashmir. 25 North Kashmir. 26 East Kashmir and Maru. 27 South Kashmir and north Udhampur. 28 Jammu, Kathua, and south Udhampur. 29 West Zaskar, Nunkun, and east Udhampur. 30 East Zaskar, Ladakh, and Nubra. 31 Rupshu and Demchok. 32 Chamba and Pangi. 33 Dharmsala, Dalhousie, and west Kangra. 34 Mandi. 35 East Kangra, Rohtang, Kulu, and Parbatti. 36 Lahul and Spiti. 37 Simla and Hill States, Mahasu, Sirmaur, and Chhachpur. 38 Kinnaur. 39 Jaunsar/Chakrata. 40 Dehra Dun, Mussoorie, and Nag Tibba. 41 Uttarkashi and Gangotri. 42 Tehri Garhwal and west Chamoli. 43 North Chamoli (inc. British Garhwal). 44 Lansdowne and Garhwal. 45 Central Kumaon (South Chamoli, North Almora, and Pindari). 46 South Almora. 47 Nainital. 48 Pithoragarh.
Nepal: 49 Dandeldura and Api. 50 Siligarhi, Doti, and Saipal. 51 Rara, Jumla, and Dailekh. 52 West Nepalese Siwaliks. 53 Rukumkot and Dhaulagiri. 54 Inner Nepal, Mustang, and Mukhtinath. 55 Annapurna, Lamjung, and Pokhara. 56 Tansing (Tansen). 57 Gurkha, Manaslu, and Ganesh. 58 Chitawan, Kathmandu valley, Shivpuri, and Bhadgaon. 59 Langtang, Ghumtang, and Charikot. 60 Khumbu, Everest, and Chamlang. 61 Sindhuli Gari and Churia Ghati. 62 Dhankuta, Topke Gola, Taplejung, and West Kanchenjunga. 63 Hangsari and Ilam.
Sikkim and N.W. Bengal (India): 64 Sandakphoo, Phalut, Darjeeling, and Kalimpong. 65 North Sikkim. (For convenience area 64 and 65 are referred to as Sikkim.)
Tibet (China): 66 Yatung and Chumbi.
Bhutan: 67 West Bhutan and Thimphu. 68 Punakha and Mangde Chu. 69 Bumthang. 70 South-central Bhutan. 71 Shingbe and Trashiyangsi. 72 Dewangiri, Sakden, and east Bhutan.
Assam (India): 73 Duars. 74 Kameng Frontier Division and Tezpur. 75 Subansiri Frontier Division and north Lakhimpur. 76 Siang Frontier Division and Dihang. 77 Luhit Frontier Division. 78 Dibrugarh, Tirap Frontier Division, and south Lakhimpur. 79 Sibsagarh, Nagaland, and Kohima. 80 Manipur (Imphal). 81 Tripura, South Cachar, Mizo, and Lushai. 82 Mikir

and North Cachar. 83 Khasia-Jaintea Hills. 84 Garo Hills. (For convenience areas 73 to 84 are referred to as Assam.)

2. THE PLAINS: *Pakistan:* 85 Lowland Pakistan east of the Indus.
India: 86 West Indian plains. 87 Central Indian plains. 88 Eastern Indian plains.
Bangladesh: 89 North Bangladesh and the delta. 90 Chittagong and hill tracts.

3. SOUTH INDIA: *India:* 91 North-western Ghats, Mahabaleshwar, and Dangs. 92 Central-western Ghats, Mysore, north and south Kanara, Chikmagalur, and Coorg. 93 Nilgiris, Calicut, and Coimbatore. 94 Anamalai Hills and Ernakulam. 95 Palni Hills and Madurai. 96 North-eastern Ghats and Vishakhapatnam. 97 Central-eastern Ghats and Nellore. 98 South-eastern Ghats, north Arcot, Shevaroy, and Pachaimalai Hills. 99 Southern Ghats, Rajapalaiyam, and Trivandrum.

4. CEYLON: *Sri Lanka:* 100 Sri Lanka (Ceylon).

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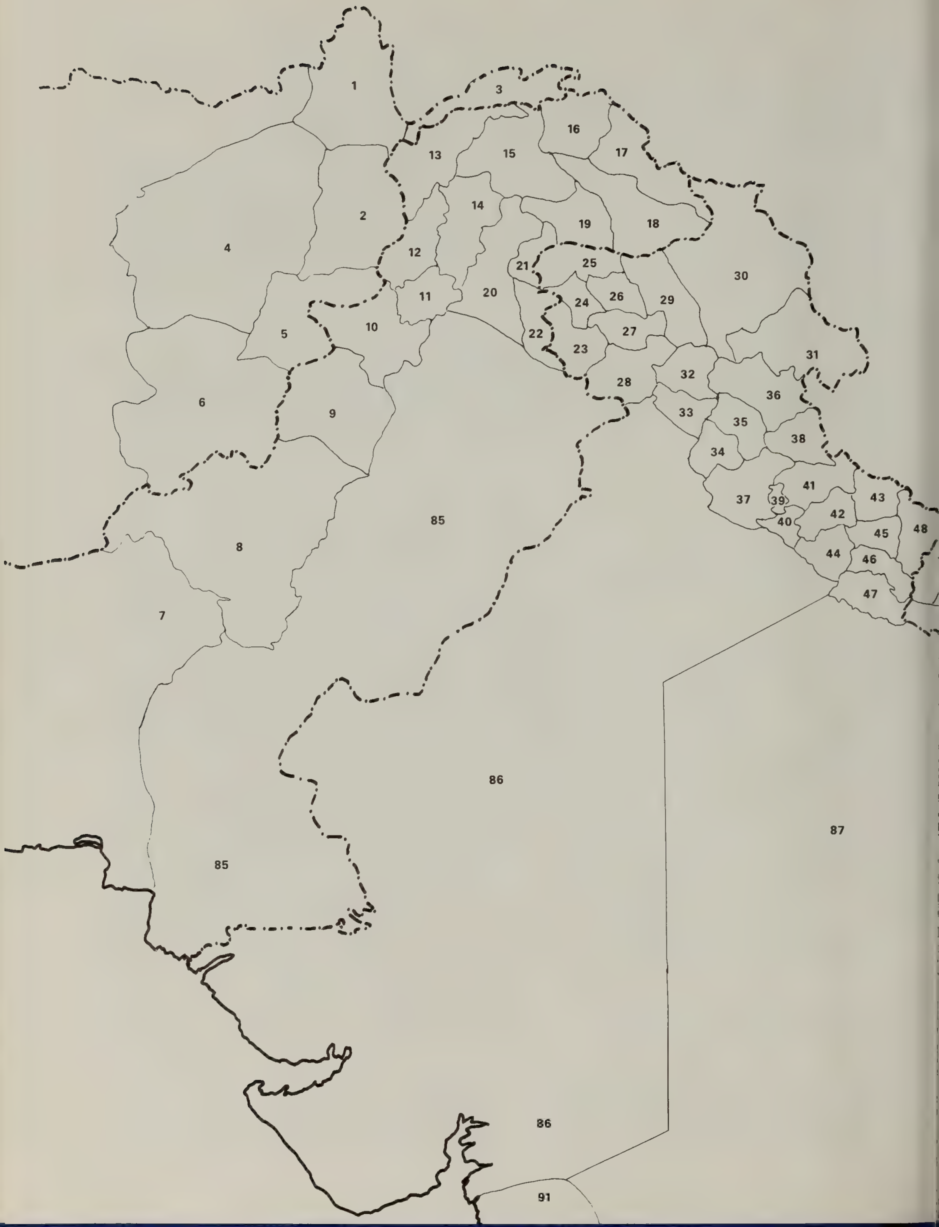
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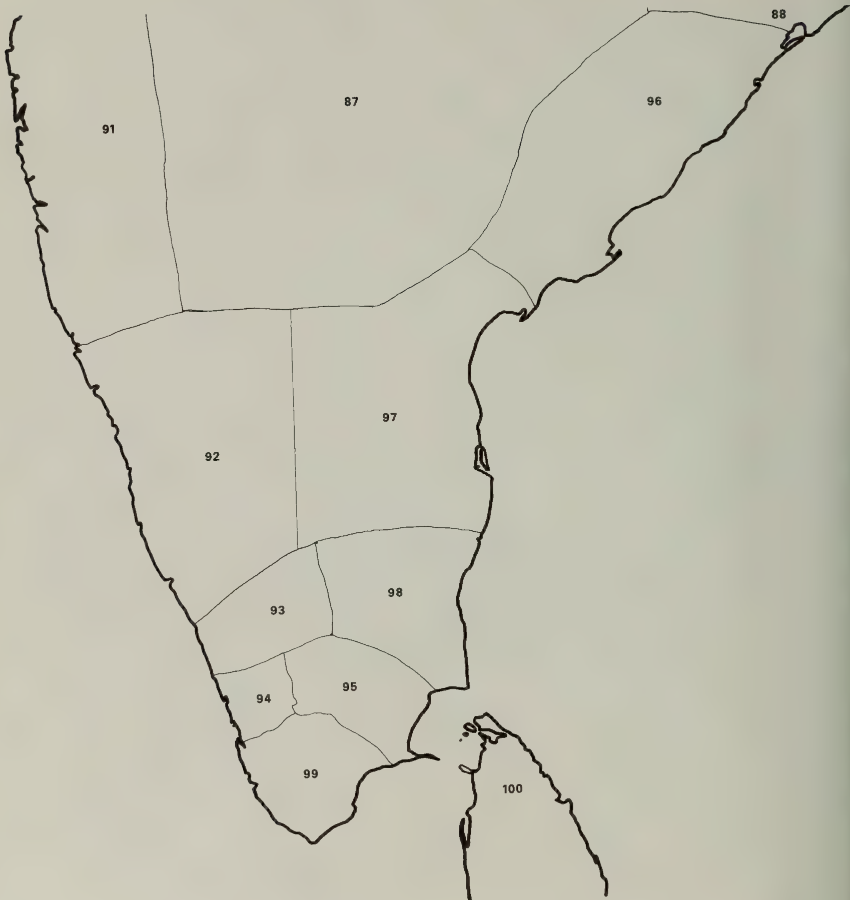
Fig. 1 Regions of the Indian subcontinent.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A revision of African Sphagnales

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A revision of African Sphagnales

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Contents

Synopsis

A revision of the Sphagnales of Africa and the East African islands is presented. Twenty species are recognized, and the treatment includes a key, descriptions, synonymy, figures of the taxa, and brief discussions of their status and interrelationships. *Sphagnum slooveri* A. Eddy sp. nov. and *S. tumidulum* var. *confusum* A. Eddy var. nov. are described, and *Acrosphagnum* C. Müll is regarded as a subsection in section *Subsecunda*. The Asiatic species *S. cuspidatulum* C. Müll. and *S. ceylonicum* Warnst. are recorded for the first time in Africa. The following new combinations are made: *S. magellanicum* Brid. subsp. *grandirete* (Warnst.) A. Eddy, *S. truncatum* Hornsch. var. *bordasii* (Bescher.) A. Eddy, *S. planifolium* C. Müll. var. *angustilimbatum* (Warnst.) A. Eddy, and *S. planifolium* var. *rugegense* (Warnst.) A. Eddy.

Historical background

The history of *Sphagnum* study in Africa follows familiar lines. It began slowly and spasmodically with Bridel's (1826) descriptions of *S. ericetorum* and two other uncertain (and now untraceable) taxa from the East African islands, and with Hornschuch's (1841) treatment of *S. truncatum* and *S. capense* from South Africa. Little progress followed until the latter half of the century when much of the botanically unexplored regions were becoming accessible. The results of botanical exploration contained fairly numerous specimens of *Sphagnum*, especially from the East African islands and the Cape region. Predictably, repeated collections of what would later prove to be the same taxon were no hindrance to their being described as new species. By 1897 Cardot, in his *Répertoire sphagnologique*, was already able to list 45 'species' and numerous varieties. Names continued to be added to the South African flora, largely due to Warnstorf (1911, etc.), by which time (1908 onwards) various collections were becoming available from some of the high mountain regions of East Africa. New species from that area were being described as recently as 1955.

Characteristically, Warnstorf figures prominently among the authors of new species, but his output (1890–1911) seems to have been somewhat reserved in comparison with his treatment of South American material during the same period, presumably indicating that the genus figures

less prominently in its African habitats than it does in, for example, Brazil. Cardot's *Répertoire* (1897) is basically an overview of the genus and contains few systematic evaluations of the species listed therein. No more recent publication has taken account of the African flora as a whole, although Garside (1949), in his account of *Sphagnum* in southern Africa, went some way towards rationalizing the position with regard to that region. This treatise, and the earlier (1926) simplistic treatment by Sim, have been recently superseded in Magill's (1981) coverage.

Ecology

Temperate zone populations of *Sphagnum*, especially where the genus is an important element of peatland vegetation, have been subjected to exhaustive ecological investigations. No such detailed work has yet been carried out on African populations nor is there any evidence to suggest that the broad requirements of *Sphagnum* in Africa differ from those of its holarctic species. Therefore a markedly regional distribution is to be expected on the continent, its pattern reflecting a similar distribution of relatively cool, moist climatic régimes. At European latitudes a mean annual rainfall of about 1500 mm is the minimum amount that will support healthy *Sphagnum* growth on ground with unimpeded drainage, but this must be part of a seasonal cycle that does not have a marked dry period. The basic rainfall requirement may be reduced in areas of extreme oceanicity, particularly where mists are frequent and evaporation impeded, but is likely to be higher within the tropics where exposed populations are subjected to periods of relatively intense radiation. The genus is not adapted to withstand seasonal dry periods, although reasonable survival of occasional droughts has been observed in Britain. High rainfall alone does not account for the observed distribution of the African species, for *Sphagnum* is absent from vast areas of equatorial rain-forest where annual precipitation is more than adequate. On the whole, sphagna are only moderately shade tolerant, and very few species have developed affinities for even mildly base-rich soils (and the latter are so far only known at much higher latitudes). Vigorous phanerogamic growth, high rates of leaf-litter deposition, and varying degrees of edaphic improvement have proved to be effective barriers to incursion of the genus.

A number of species either require, or are tolerant of, sub-aquatic or riparian habitats. Such species are therefore to some degree independent of precipitation provided that groundwater sources are maintained and they are oligotrophic in character (pH values below 4·5). The subgeneric divisions *Cuspidata* and *Subsecunda* are noted for the aquatic predilections of many of their species, *S. planifolium* and *S. truncatum* providing good African examples. Colonies of these plants are seldom large in extent, probably because of the often temporary nature of their habitats (water level changes, stream-bank erosion, etc.) but are able to survive, apparently for long periods in some cases, in localities which would otherwise be climatologically unsuitable. In general terms, however, *Sphagnum* forms a significant part of the bryoflora only in those regions that have a climatic regime that more or less closely resembles that found, for example, in western Europe. Broadly speaking, the regions correspond to the 'Afromontane' zone (*sensu* e.g. White, 1978). Local topography, prevailing winds, and proximity to the oceans have profound effects on the altitude of the zone but, in the broadest terms, it comes in at around the 2000 m contour, being depressed in the Cape region but somewhat higher in Ruwenzori and western Usambara.

Taxonomic treatment and evolutionary history

In dealing with the taxonomy of African sphagna, we are faced with a number of problems, the results of several interacting variables, some of which may be either insoluble or require chemo-systematic and/or biosystematic investigations that are currently impossible to pursue. Clearly, we are working with a number of essentially island populations, with varying degrees of divergence or commonality in regard to their *Sphagnum* floras. There is more or less universal agreement among geophysicists that these 'islands' are the end products of phases of tectonic and orogenic movements that had their onset about mid to late Cretaceous. The major events

affecting the phytogeography of *Sphagnum* included: 1. the early separation of the African plate from the South American–Australasian–Antarctic mass; 2. the northwards drift (mid-Cretaceous to early Tertiary) of the African continent until it met Laurasia (closing the Tethys in mid-Miocene); 3. warping and uplift, concentrated along eastern Africa during the Miocene; 4. the drastic climatic fluctuations of the Pliocene and Pleistocene (Axelrod & Raven, 1978).

Paleoclimatologists visualise the continent as a whole, when it was 15°–18° further south, as having an overall cooler and moister climate with more widely distributed and probably more or less continuous zones of vegetation. There is little doubt that *Sphagnum* was a widespread genus during this period, but became progressively restricted during the northwards drift as temperatures rose and arid zones widened. Extinction might have been more widespread were it not for the refugia provided by the Miocene uplifting and vulcanism in the east.

Speciation rates of bryophytes in general are low, and that of *Sphagnum*, at least within tropic latitudes, is probably near the bottom end of a depressed scale. Evolutionary forces are operating almost entirely on the haploid generation of its life cycle. Furthermore, the outbreeding potential of most *Sphagnum* species (the majority being dioecious), which is almost negligible among present-day populations, is likely never to have been high. Therefore, the episodes of rapid speciation that occurred among flowering plants, particularly during the Miocene and Pliocene–Pleistocene periods, had muted and possibly sometimes undetectable effects in *Sphagnum*. Genetic changes that have produced markedly distinct species or even genera of angiosperms are paralleled by such minor modifications in *Sphagnum* that it is difficult to draw the line between genuine evolutionary steps and simple local and spasmodic variants. At any rate, endemism at species level is very low in Africa generally, although many of the regional variants, treated below as varieties or subspecies, might be raised again to species rank by some authors. The present author prefers the more conservative approach (admittedly somewhat arbitrarily applied at times) in which the distinction of species rests on more than one character and is more or less clearly defined throughout the range of the taxon. Regional variants, sometimes resting on a single character, are mainly regarded as subspecies, while distinctive but apparently more or less random variants are accorded varietal rank. This, admittedly arbitrary, treatment has nevertheless shown up patterns of distribution that are significant from the standpoints of evolutionary history and phytogeography.

Madagascar presents something of a special case for, while its *Sphagnum* flora is clearly derived from that occupying the Ruwenzori/Usambara afromontane region and has many species in common with it, it has also an exceptional number of endemic species. It has only recently been established beyond reasonable doubt that (*a*) the original position of Madagascar was adjacent to Kenya/Somalia and not further south, and (*b*) initial separation of the Madagascar sub-plane was an early event, i.e. before mid-Cretaceous (Smith, 1976). While it is at present impossible to estimate at what point interchange between the island and mainland floras was terminated, it seems to have been sufficiently early to allow the evolution of endemic forms (e.g. the almost stenotypic *S. tumidulum*). It is significant, perhaps, that of those 'continental' species which appear to be unaltered in Madagascar, the majority are exceptionally fertile members of the genus (e.g. *S. strictum* subsp. *pappeanum*) so that long-range dispersal might have been possible. At this juncture it should also be pointed out, however, that some disjunct taxa, e.g. *S. ceylonicum*, occur in East Africa and Madagascar in more or less identical facies but are very rare, or unknown as fruiting plants. Clearly, such taxa are plaeo-disjunct relics, and in the case of the species mentioned, its occurrence in virtually the same form also in Sri Lanka is significant.

The diversification into the major infra-generic groups (i.e. subgenera and sections now widely accepted) of *Sphagnum* is almost certainly pre-Gondwanan, and those represented in Africa correspond closely with the other continents (i.e. subgenera *Rigida* and *Sphagnum*; sections *Acutifolia, Cuspidata* and *Subsecunda*). Species and species-aggregates, however, apart from the previously documented pan-tropical taxa *S. perichaetiale* and *S. strictum* (Eddy, 1977), are largely endemic to Africa. Links with Asia rest on the occurrence of *S. ceylonicum* (referred to above) and the recently discovered *S. cuspidatulum* in Madagascar. Tenuous links with the tropical South American flora are mainly at supra-specific level (e.g. *S. gracilescens* is thought to

have common ancestry with *S. capensis* agg.; *S. cucullatum* is similarly related to *S. truncatum*). There are no apparent links with the Australasian flora to suggest any significant post-Jurassic interchanges. Perhaps the most problematical links, if such they are, between the Eurasian and African floras are represented by the occurrence of *S. cuspidatum*, a widespread holarctic species, in Madagascar and Ruwenzori/Usambara. Possibly the Ethiopian region, at a time when it enjoyed a more equable climate, formed a migratory bridgehead. Phytogeographical considerations are developed somewhat further in the notes appended to the species descriptions below.

The subgeneric divisions of the genus *Sphagnum*, as interpreted by the present author, are the same as those that have been already described and discussed in relation to the tropical Asiatic flora (Eddy, 1977), with the addition of a subordinate group (i.e. subsection) that is almost endemic to Africa. Thus, subgenera *Sphagnum, Rigida* and *Isocladus* all occur, the latter subgenus represented by sections *Subsecunda, Cuspidata* and *Acutifolia*. Of the groups listed above, section *Subsecunda* is perhaps the most ancient in origin, with a consequently wide geographical range and morphological diversity. A more or less well defined, African element, previously categorised (Eddy, 1979) as the '*Sphagnum capense*' group, is worthy of distinction. C. Müller (1887) recognized the group, using the descriptive term '*Sphagna mucronata*' but placed it in the subgeneric group '*Acrosphagnum*'. A description and short discussion is presented at the appropriate place in the text (see p. 116).

Citation of specimens

As already stated above (p. 78) most of the specimens examined (all cited specimens have been seen by the author) originate from the relatively few regions of Africa where the degree of oceanicity is enhanced by high altitude and/or proximity to coasts. Specimens are therefore grouped into the five broad categories: 1. West Africa – relatively few records of scattered occurrence from Sierra Leone south to western Zaire and Angola; 2. Southern Africa – mainly from Cape Province but extending eastwards to Transvaal and Natal; 3. Mlanje/Chimanimani – the high ridges and plateaux of Zimbabwe, Malawi and northern Mozambique; 4. Ruwenzori/Usambara – the high altitude ridges of eastern Zaire, Rwanda, Uganda, Kenya and northern Tanzania; 5. East African Islands – principally Madagascar, Mauritius and Réunion.

SPHAGNUM L.

Sphagnum L., *Sp. pl.* **2**: 1106 (1753); *Gen. pl.* 5th ed.: 487 (1754).
Lectotype: *Sphagnum palustre* L., cf. Britton, *Fl. Bermuda*: 431 (1918).

Sphagnum, as interpreted by modern authors, is the only genus in the class Sphagnopsida. Its characters are sufficiently numerous, conspicuous and unique, and have been so thoroughly documented that a full generic description is unnecessary here. Good definitions are presented in most bryological handbooks, dating back as far as the classic works of Schimper (1857) and Braithwaite (1880). Generic subdivisions, which are more or less coincident with those presented by Isoviita (1966), are the same as those presented in Eddy (1977). Therefore synonymies of the higher taxonomic divisions are presented less fully in this paper, and include only additional and recently used names.

Key

1a Branch leaves large, more than 1·6 mm long, concave with markedly blunt, hooded apices. Stem leaves lingulate to spathulate, more than 1·4 mm long. Stem cortex highly developed, 3 or more layered. Cortical cells of branches more or less uniform, few to many with large pores, normally furnished with distinct spiral fibrils, at least on the inner walls (subgen. *Sphagnum*) 2

1b Branch leaves various: if large and hooded then stem cortex not highly developed (i.e. 1–2 layered) or stem leaves small, under 1·3 mm long. Cortical cells of branches dimorphic or, if uniform, then without fibrils 3

2a Branch-leaf chlorocysts urceolate in section, always distinctly exposed on the adaxial leaf surface and normally reaching the abaxial surface. Cortical cells of stem uniformly 1-porose (very rarely 2-porose in an occasional cell adjacent to the insertion of a fascicle or stem leaf) .... **1. S. perichaetiale** (p. 83)

2b Branch-leaf chlorocysts mainly oval in section and completely immersed (only here and there reaching to the leaf surface). Cortical cells of stem often 2- or more porose .... **2. S. magellanicum** subsp. **grandirete** (p. 87)

3a Plants very robust, with markedly dimorphic branches. Branch leaves more than 2·0 mm long, usually subsquarrose, but stem leaves very small, under 1·3 mm long. Hyaline cells of branch leaves short and wide (over 30 μm), with pseudolacunae on the adaxial side. Cortical cells of branches not dimorphic, the majority having a large apical pore .... **20. S. strictum** subsp. **pappeanum** (p. 155)

3b Plants small to medium sized or, if robust, then branches not markedly dimorphic and stem leaves more than 1·4 mm long and branch-leaf leucocysts long and narrow, without adaxial pseudolacunae. Cortical cells of branches, at least distally, dimorphic with distinct retort cells 4

4a Stem leaves lingulate to spathulate, very broad and fimbriate at apex and devoid of fibrils 5

4b Stem leaves various, sometimes truncate and dentate or eroded above but very rarely broadly fimbriate and rarely devoid of fibrils 6

5a Stem leaves strongly widened above and fimbriate around the whole upper portion. Chlorocysts of branch leaves with wider exposure on the adaxial leaf face. Branch leaves never in regular rows .... **5. S. fimbriatum** (p. 97)

5b Stem leaves not conspicuously widened above. Chlorocysts of branch leaves with wide abaxial exposure, often immersed on the adaxial side. Branch leaves 5-ranked .... **19. S. cuspidatulum** (p. 153)

6a Middle and upper branch leaves narrowly lanceolate to linear, more than 2·5 times as long as wide. Chlorocysts of branch leaves always more widely exposed abaxially (sect. *Cuspidata*) 7

6b Upper branch leaves lanceolate to ovate, usually less than 2·5 times as long as wide (if narrower, then chlorocysts more widely exposed adaxially) 8

7a Stem leaves typically fibrillose only in the upper half, border distinctly to markedly widened below. Branch leaves often strongly involute and appearing setaceous .... **16. S. cuspidatum** (p. 137)

7b Stem leaves typically fibrillose throughout; border not or only imperceptibly widened below. Branch leaves more or less plane to weakly involute .... **17b. S. planifolium** var. **angustilimbatum** (p. 148)

8a All or the majority of branch leaves proportionately broad, ovate, usually less than 1·5 times longer than wide (if narrower, then large, more than 1·8 mm long) 9

8b Branch leaves ovate-lanceolate to lanceolate, 1·5–2·5 times longer than wide 22

9a Plants robust; branch leaves 1·6–2·5 mm or more long 10

9b Plants small to medium sized; leaves less than 1·5 mm long 16

10a Apices of branch leaves rounded and eroded, not obviously toothed. Stem cortex 1(–2)-layered .... **9. S. africanum** (p. 113)

10b Apices of branch leaves either more or less mucronate or narrowly to broadly truncate with conspicuous teeth, if rounded and eroded, then stem cortex 2–3-layered 11

11a Abaxial (sometimes also the adaxial) surface of branch-leaf leucocysts furnished with several to very numerous small, ringed pores along the commissures. Chlorocysts in section with oval lumina and thickened end walls, with more or less equal exposure on both leaf surfaces 12

11b Abaxial surface of leucocysts without or with very few pores (sometimes with pseudopores), adaxial surface with unringed or thinly ringed, often very inconspicuous pores mainly adjacent to the cell angles. Chlorocysts in section triangular to trapezoid with conspicuously wider abaxial exposure 15

12a Stem cortex basically 2–3-layered (spasmodically 1-layered in weak specimens). Plants pale or with weakly developed secondary pigments (endemic to E. African islands) .... **8. S. rutenbergii** (p. 108)

12b Stem cortex 1-layered (sometimes up to 30 per cent 2-layered in aquatic forms). Plants often with highly developed secondary pigments, then orange-brown to purplish brown 13

13a Branch leaf leucocysts with small pores in series along the commissures on the abaxial side; adaxial side with few or no pores. Chlorocysts weakly biased towards the abaxial leaf face (not south of the Sahara) .... **6. S. auriculatum** (p. 99)

13b Branch leaf leucocysts very variable, commonly with several to numerous pores on the adaxial surface. Chlorocysts median or weakly biased towards the adaxial leaf face (not north of the Sahara) .... **(S. truncatum)** 14

14a Branch leaves often only shallowly concave, with almost flat, broad and conspicuously dentate, truncate apices. Pores very variable, often scattered and non-serial on the abaxial leaf face. Stem leaves often as large as branch leaves, fibrillose to base or almost so; leucocysts not conspicuously septate .... **7a. S. truncatum** var. **truncatum** (p. 105)

14b Branch leaves very concave, with more or less involute margins above. Pores usually very numerous and more or less serial on the abaxial leaf face. Stem leaves shorter than branch leaves, sometimes efibrose in the lower half but often with very numerous septa .... **7b. S. truncatum** var. **bordasii** (p. 106)

15a Branch-leaf leucocysts with few or no pores on the abaxial side; adaxial side with rather faint pores more or less confined to the cell angles. Stem leaves normally fibrillose to insertion .... **17a. S. planifolium** var. **planifolium** (p. 146)

15b Branch-leaf leucocysts with 0–several pores and/or pseudopores on the abaxial side; adaxial side with numerous, sometimes serial and occasionally distinctly ringed pores scattered along the commissures. Stem leaves commonly efibrose below..................................... **17c. S. planifolium** var. **rugegense** (p. 148)

16a Branch-leaf pores minute, less than 3·0μm diameter, few, mainly adjacent to some of the cell angles on the adaxial side of leaf. Chlorocysts in section oval, deeply immersed below both leaf surfaces .... **10a. S. tumidulum** var. **tumidulum** (p. 117)

16b Branch-leaf pores small to medium sized, usually more than 3·0 μm (up to 10·0 μm), usually numerous on either or both surfaces. Chlorocysts usually narrowly exposed on one or both leaf surfaces.. 17

17a Branch-leaf pores confined to, or much more numerous on the abaxial leaf surface 18

17b Branch-leaf pores more abundant on the adaxial leaf surface 21

18a Chlorocysts of branch leaves more widely exposed on the abaxial side, rarely completely immersed... 19

18b Chlorocysts either median and exposed equally on both sides, or with widest exposure on the adaxial side 20

19a Plants relatively small and delicate, never with more than 4 branches per fascicle. Branch leaves variable, often blunt or truncate-dentate at apex. Stem leaves typically lingulate to spathulate and rounded-obtuse at apex, rarely pseudomucronate, usually fibrillose almost or quite to base.. **12. S. capense** (p. 124)

19b Plants rather robust, rigid, with 5–6 branches per fascicle. Branch leaves abruptly inrolled at apices and appearing acute or pseudomucronate. Stem leaves typically oval-triangular and pseudomucronate, often fibrillose only in the upper half. (Chlorocysts narrowly exposed abaxially)... **13. S. pycnocladulum** (p. 130)

19c Plants rather weak, with 3–5 branches per fascicle. Branch leaves pseudomucronate. Chlorocysts more or less completely immersed........ **S. pycnocladulum,** *'beyrichianum'* forms (p. 131)

20a Chlorocysts of branch leaves median, with equal exposure on both leaf surfaces.................. **11. S. davidii** (p. 121)

20b Chlorocysts of branch leaves with distinctly to markedly wider exposure on the adaxial leaf surface .... **15. S. ceylonicum** (p. 135)

21a Chlorocysts of branch leaves usually completely immersed. Stem leaves with border distinctly widened below. .... **10b. S. tumidulum** var. **confusum** (p. 120)

21b Chlorocysts exposed at least on the abaxial side of leaf. Stem-leaf border not obviously expanded below. .... **14. S. ericetorum** (p. 132)

21c Chlorocysts median and exposed on both leaf surfaces, Stem leaves large, lingulate .... **11. S. davidii** (p. 121)

22a Branch-leaf apices widely truncate and conspicuously 8–12-dentate. Stem cortex basically 1-layered, never porose .... **7. S. truncatum** (forms) (p. 101)
22b Branch-leaf apices involute or rounded-truncate, 5–7-dentate. Stem cortex 2–4-layered, often with large but faint pores 23

23a Chlorocysts of branch leaves with much wider exposure on the abaxial side. Stem cortex never porose 27
23b Chlorocysts of branch leaves with equal or wider adaxial exposure. Stem cortex usually with faint, solitary pores (stain) 24

24a Branch-leaf leucocysts (20–)25–35(–40) μm wide in mid leaf; pores large (10·0–20·0 μm). Leucocysts in lower-lateral parts of leaf much larger and more porose than the upper and median 25
24b Branch-leaf leucocysts (15–)20(–30) μm wide, with numerous small to medium (c. 4·0–10·0 μm) pores. Lower-lateral leucocysts not markedly enlarged 26

25a Plants usually tinged with crimson pigments (which turn bluish in alkaline solution). Branch-leaf leucocysts 'normal', i.e. not septate .... **3. S. violascens** (p. 90)
25b Plants always pale and flaccid. Branch-leaf leucocysts often 1–4-septate ... **4. S. reichardtii** (p. 96)

26a Chlorocysts of branch leaves median, with equal exposure on both sides of leaf .... **11. S. davidii** (p. 121)
26b Chlorocysts of branch leaves with wider adaxial exposure .... **15. S. ceylonicum** (p. 135)

27a Stem leaves broadly truncate and fimbriate at apex, fibrillose only in the extreme apical region **18. S. slooveri** (p. 151)
27b Stem leaves blunt and often cucullate at apex, fibrillose in at least the upper third and often almost or quite to base .... **(S. planifolium)** 28

28a Adaxial surface of branch-leaf leucocysts with scattered unringed pores. Plants often robust with branch leaves over 1·8 mm long .... **17a. S. planifolium** var. **planifolium** (p. 146)
28b Adaxial surface of branch-leaf leucocysts with numerous, minute, heavily ringed pores. Plants usually small to medium sized with branch leaves under 1·6 mm .... **17c. S. planifolium** var. **rugegense** (p. 148)

Subgenus *SPHAGNUM*

Sphagnum L. subgen. ***Sphagnum***

Sphagnum sect. *Cymbifolia* Schimper, *Syn. musc. eur.* 2nd ed.: 847 (1876).
Sphagnum [sect.] 1. *Inophloea* Russow in *Schr. NaturfGes. Univ. Jurjeff* **3**: 27 (1887).
Type: *Sphagnum palustre* L.

More or less robust, turgid plants with cucullate branch leaves and markedly dimorphic branches. Stem hyalodermis highly developed, in 3–4 layers and with internal as well as external pores. Branch hyalodermis uniform, without distinct retort cells but few to the majority of cells foraminate. Cells of hyalodermis of branches and stems typically furnished with spiral fibrils. Outer margins of branch-leaf borders resorbed to form a resorption furrow. Leucocysts wide, with pseudolacunae on the abaxial side, those near the leaf apex typically much resorbed in the apical half on the abaxial side, the remainder characteristically projecting and scale-like (hence leaf tip appearing minutely scabrid).

1. Sphagnum perichaetiale Hampe
(Figs 1 & 2)

in *Linnaea* **20**: 66 (1847). Type: Brazil, *Beyrich* s.n. (BM – holotype).
S. balfourianum Warnst. in *Hedwigia* **30**: 153, tab. 17 fig. 21, tab. 22 fig. z (1891).
S. arbogastii Ren. & Cardot in *Bull. soc. r. Bot. Belg.* **32** (2): 8 (1893).
S. marlothii Warnst., *Sphagnol. univ.*: 471, fig. 79A (1911).
S. drouhardii Cardot apud Ren. & Cardot in A. & G. Grandidier, *Hist. phys. Madagascar* **39**: 42 (1915).

Note: possibly the earliest name for this taxon is *S. patens* Brid. (1806), also given as *S. cymbifolium* var. *bourbonense* P. Beauv. and, later, *S. cymbifolium* var. *patens* (Brid.) Brid. (1826). No specimen of *S.*

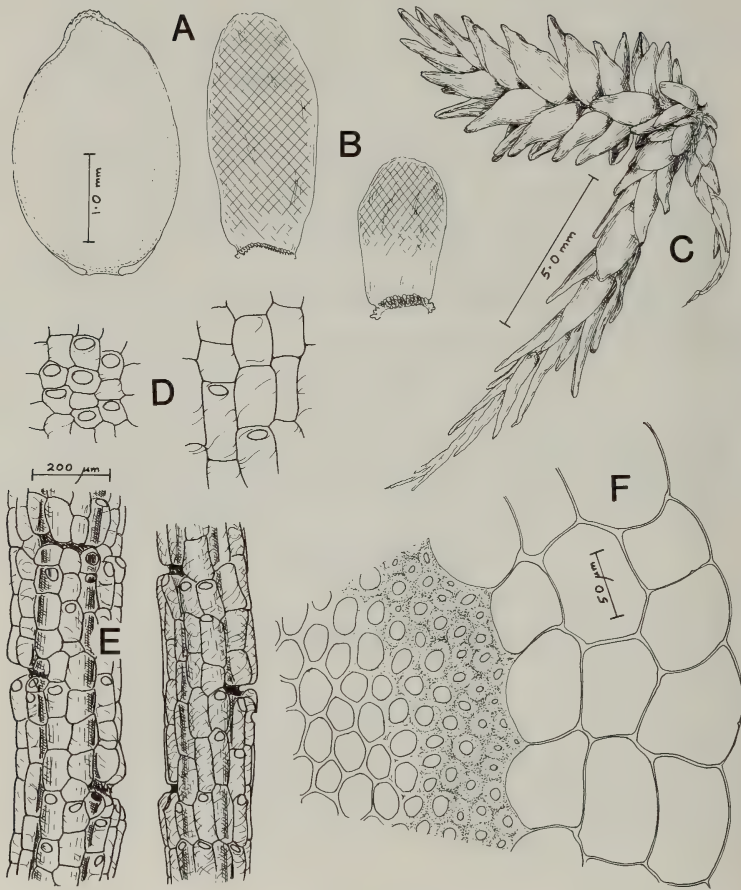

Fig. 1 *Sphagnum perichaetiale* Hampe. A, branch leaf (left); B, stem leaves; C, branch fascicle; D, stem cortex; E, branch cortex; F, transverse section of stem (B, left fig., and E, left fig. drawn from the type of *S. balfourianum*; the remainder from the type of *S. arbogastii*).

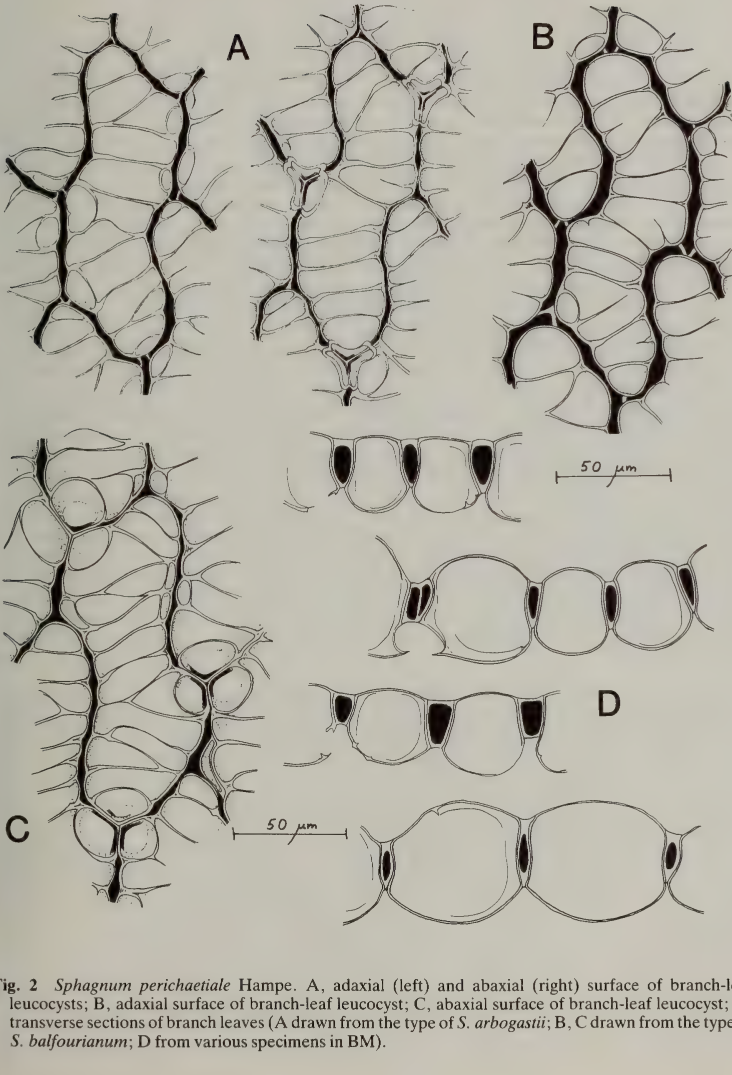

Fig. 2 *Sphagnum perichaetiale* Hampe. A, adaxial (left) and abaxial (right) surface of branch-leaf leucocysts; B, adaxial surface of branch-leaf leucocyst; C, abaxial surface of branch-leaf leucocyst; D, transverse sections of branch leaves (A drawn from the type of *S. arbogastii*; B, C drawn from the type of *S. balfourianum*; D from various specimens in BM).

patens could be traced in Bridel's herbarium, and the description, which is inadequate for positive identification, could equally well apply to *S. magellanicum* or even some unrelated species. *S. patens* Brid. and its synonyms are dismissed here as *nomina ambigua*.

Plants rather robust, yellowish to brown, with or without additional dull red-brown or purplish pigmentation, compact to rather lax. *Fascicles* composed of 4–5 branches: 2 spreading branches of somewhat tumid appearance, blunt or tapering distally, 8·0–18·0 (–25·0) mm long; 2–3 pendent branches strongly deflexed, pale and relatively thin and attenuated (i.e. branches rather strongly dimorphic). *Stems* 0·8–1·2 mm diameter; cortex very well developed, of 3(–4) layers of large leucocysts which usually have sparse to numerous spiral fibrils; internal walls, end walls and external walls all furnished with large pores, the exposed outer walls each with a single pore. Internal cylinder strong, dark brown. *Branch cortex* uniform, of a single layer of large leucocysts which are usually fibrillose (especially in distal parts of branches), some or all of them with a single, non-protuberant pore. *Stem leaves* very variable, sometimes (strong, heterophyllous plants) short-lingulate and almost, rarely completely, efibrose, sometimes (weaker plants) strongly fibrillose and resembling branch leaves in morphology, usually more or less spathulate and rather weakly fibrillose in the upper half. Apex typically broadly rounded with a thin, ephemeral border, appearing variously eroded or more or less fimbriate. Border not expanded, much resorbed above. Leucocysts strongly resorbed on the adaxial side. *Branch leaves* erect-spreading, large and very concave, broadly ovate, 1·4–2·4 mm long, 1·0–1·5 mm broad; apices strongly hooded and usually scabrid dorsally due to projecting, partially resorbed hyaline cells; border thin, of a single cell row, with a resorption furrow. *Leucocysts* comparatively broad and strongly convex, (25–)30–40(–50) μm wide, 80–200 μm long. Abaxial surface, in mid leaf, with pseudolacunae or 'triple pores' at the conjunction of basal and lateral angles of adjacent cells but with no, or very few, additional ringed pores in the other cell angles or against the commissures; near leaf apex with a large resorption gap in the apical angle; pseudopores usually present in some lateral angles. Adaxial surface usually lacking pores in mid-leaf but 2–4 series of leucocysts in the lower marginal zones of leaf with few to several large, circular pores (*c.* 15·0–20·0 μm) on both surfaces. *T.S. leaf.* Leucocysts plane to moderately convex adaxially, very strongly convex abaxially. Photosynthetic cells relatively narrow, urceolate to more or less oval trapezoid with oval lumina, abaxial wall strongly thickened, rather narrowly (2·0–6·0 μm) exposed on the adaxial side, just reaching, or much more narrowly exposed on the abaxial side (there sometimes appearing immersed due to the degree of convexity of adjacent leucocysts). *Dioecious*. Male plants either absent or of very rare occurrence in the African range of the species. Female plants detected among some gatherings but always in an unfertilized condition (see Eddy, 1977).

Distribution. S. perichaetiale is a pan-tropical species which is widespread in Central and South America, Malaysia, and southern North America. It is much more local in its African occurrence generally, but is common in the East African islands. No plausible explanation has been found to explain its absence from East Africa in view of its presence both in South Africa and Angola, there being no shortage of edaphically and climatically suitable locations for the species in, for example, the Ruwenzori range.

West Africa. ANGOLA: Huila, *Gossweiler* 2804 (BM).

Southern Africa. CAPE PROVINCE: Table Mountain, 1020 m alt., *Marloth* s.n. (BM – isotype of *S. marlothii*); *Taylor* 1105 (BM). Steenberg, 'rocks in stream . . .', *Esterhuysen* 15839 (BM, PC; female but unfertilized plant); mountains above Hermanus, *Vogelpoel* CH 12796 (PRE); Groot Kop, Twelve Apostles, on marshy ground by stream, 800 m alt., *Pillans* 4280 (PRE); between Bot River and Kleinmoud, near a stream below Highlands Forest Dept. road, *Middlemann* 24977 (PRE).

East African Islands. MADAGASCAR: Ankafiafé, *Arbogast* s.n. (PC – type collection of *S. arbogastii*); Fianarantsoa, *Besson* s.n. (PC); '. . . forêt de Manongiarivõ, . . .' *Drouhard* s.n. (PC – type collection of *S. drouhardii*; Androranga, Mount Anjenabe, 600–800 m alt., *Humbert & Capuron* s.n. (PC); 'Marais pres d'Ambohimasoa', 1100 m alt., coll.? (PC); Mt. Itrafanomby, Ankazondrano, *Humbert* s.n. (PC); Andovoranto, *Humbert* 565 (BM, PC); 'Mountain west of Itremo', *Humbert* s.n. (9th voyage) (PC); Plateau d'Isalo, 500–1000 m alt., *Humbert* s.n. (PC); Massif du Tsaratanana, *Humbert* s.n. (5th voyage) (PC); Fort Dauphin, *Decary* s.n. (PC); *Cremers* 2963 (NAM); Marojejy, 2050 m alt., *Guillaumet* 4068,

4069a, 4211 (NAM, BM); Fort Dauphin, 'on sand between Ericas', 100 m alt., *Onraedt* 71.M.5506, 71.M.5535, 71.M.5540, 71.M.5555 (NAM, BM); Massif d'Isalo, Canon des Singes, *Onraedt* 71.M.5732; Tananarive, Lac du Mantasoa, *Onraedt* 74.M.2106, 74.M.2109 (NAM, BM). MAURITIUS: *Balfour* s.n. (BM, herb. Mitten – type collection of *S. balfourianum*); in bog, north of Mt. Cocotte, 600 m alt., *Onraedt* 71.Ma.045, 71.Ma.0234, 71.Ma.0236 (NAM, BM). RÉUNION: *Bosser* 8275pp (BM, PC mixed with *S. pallidum*); Plaine des Cafres, in bog, 1600 m alt., *Onraedt* 69.R.0476, 69.R.0477 (NAM).

Subgenus *Sphagnum* is comparatively easy to recognize, even superficially, with its strongly hooded leaf tips and dimorphic branches. There are, however, no superficial characters by which *S. perichaetiale* can be distinguished from *S. magellanicum*. Under the microscope, the uniformly 1-porose stem cortex and the adaxially exposed chlorocysts are the more important features of *S. perichaetiale*. *S. magellanicum* usually has more abundant branch-leaf pores, and at least a proportion of stem-cortical cells with two or more pores in the external walls.

S. perichaetiale is a species of great antiquity, and is the most 'primitive' member of its subgenus. Many of its populations are of a relict nature, and it has without doubt disappeared from many of its former sites. Nevertheless, it is difficult to account for its apparent absence from continental East Africa in view of its relatively frequent occurrences in the East African islands.

2. Sphagnum magellanicum Brid. subsp. **grandirete** (Warnst.) A. Eddy, **comb. nov.** (Figs 3 & 4)

S. grandirete Warnst. in *Magy. Bot. Lap.* **1**: 43 (1902). Type: Madagascar, Androrangabe, Andovoranto 'ab indig. collect., 1901' (PC).

Plants relatively large, lax or rather compact, brown to purple-brown with indistinct to distinct crimson tints. *Fascicles* composed of 3–5 strongly dimorphic branches: 2 spreading branches more or less tumid, 10–20 mm long, blunt or slightly tapering with age; 2–3 pendent branches of varying length but weak, relatively pale, more or less appressed to stem. *Stems* 0·8–1·1 mm diameter. Cortex highly developed, of 3–4 layers of leucocysts which are usually furnished with thin, more or less spiral fibrils and pores; exposed faces of outer leucocysts with 1–2(–4) pores, rarely all with just a single pore; inner radial walls also with 1–3 pores. Internal cylinder strong, dark red-brown. *Branch cortex* not dimorphic, normally fibrillose (at least in the distal parts of branches), some or a majority of leucocysts with a large pore near the upper end. *Stem leaves* variable, lingulate to spathulate, 1·2–1·8 mm long, 0·9–1·2 mm broad; border narrow, largely resorbed, forming a thin, ephemeral band 2–3 cells wide around the whole apical margin; not expanded below. Leucocysts in upper leaf region variable, typically short and wide and lacking fibrils or more elongated and weakly fibrillose; adaxial surfaces largely resorbed. *Branch leaves* large, (1·4–)1·6–2·5 mm long, very concave, broadly ovate to more or less orbicular or cochleate; apices strongly cucullate and more or less scabrid dorsally (due to projecting dorsal leucocyst walls); border thin, of 1(–2) cell series, with a well marked resorption furrow. Pendent-branch leaves ovate to ovate lanceolate, the distal often unbordered. *Leucocysts* wide, 20·0–35·0(–40·0) × 90·0–170·0 μm in upper mid leaf. Abaxial surface with well marked 'triple pores' in the conjunction of the basal and lateral angles of adjacent leucocysts, with or without additional rather large, ringed pores elsewhere; commonly with a large resorption gap in the apical angle, especially towards leaf apex. Adaxial surface with or without 1–3 large, circular, unringed pores, about 20 μm diameter; 3–4 series of leucocysts in lateral leaf regions more or less equally porose on both sides. *T.S. leaf*. Leucocysts shallowly and more or less equally convex on both sides or rather more strongly convex abaxially. Chlorocysts small, narrowly oval, the majority thin-walled and completely immersed, only here and there reaching the adaxial surface via a thickened anterior wall (possibly derived from adjacent leucocysts rather than the chlorocyst itself). *Dioecious*. Fertile material rare in the species and unrecorded in subspecies *grandirete*.

Distribution. The type subspecies of *S. magellanicum* is circumpolar in the northern hemisphere and has a bipolar range in as much as it is also common locally in South America and on some of the sub-antarctic islands. In Africa, the species appears to be represented only by subspecies *grandirete*, which is apparently rare and local, being confined to the East African islands.

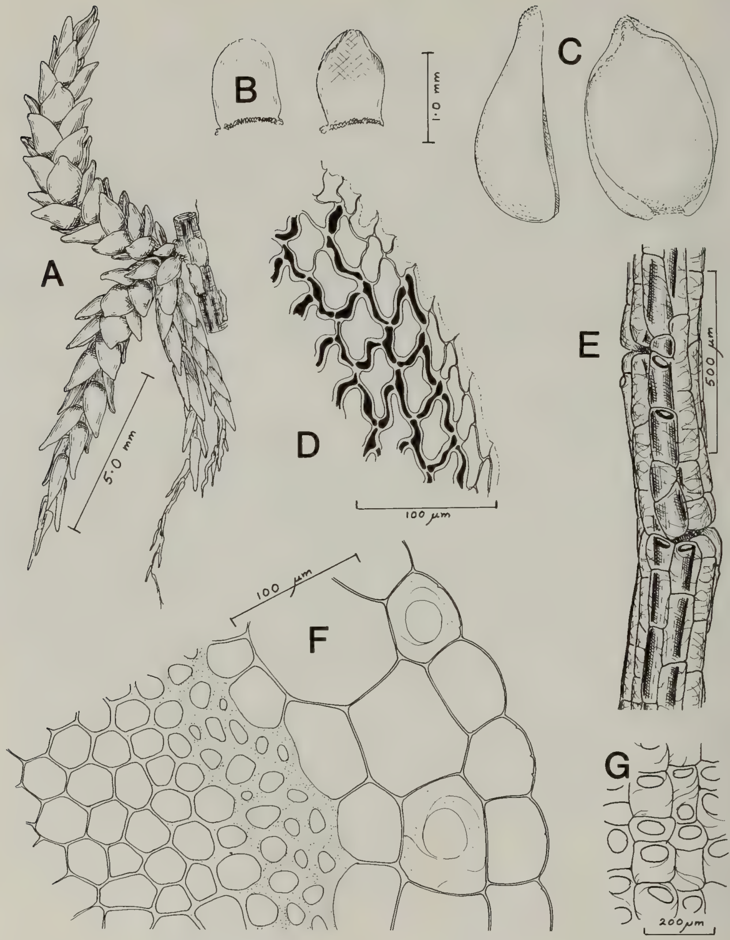

Fig. 3 *Sphagnum magellanicum* Brid. subsp. *grandirete* (Warnst.) A. Eddy. A, branch fascicle; B, stem leaves; C, branch leaves; D, upper margin of stem leaf; E, branch cortex; F, transverse section of stem; G, stem cortex (all drawn from the type collection of *S. grandirete*).

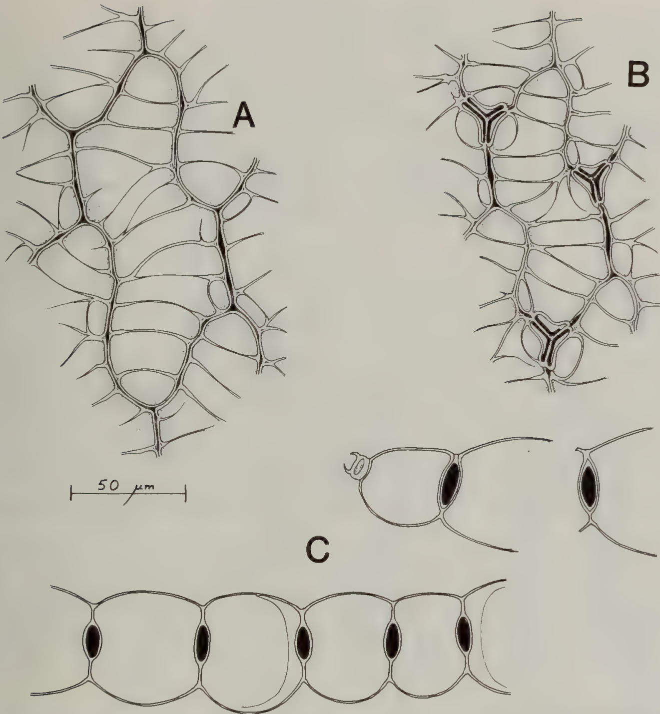

Fig. 4 *Sphagnum magellanicum* Brid. subsp. *grandirete* (Warnst.) A. Eddy. A, adaxial surface of branch leaf; B, abaxial surface of branch leaf; C, transverse section of branch leaf (all drawn from the type).

East African Islands. MADAGASCAR: Androrangabe, Andovoranto, 'ab indig. collect., 1901' (PC, herb. Renauld and herb. Paris – isotypes of *S. grandirete*).

S. magellanicum subsp. *grandirete* is superficially indistinguishable from *S. perichaetiale* and is clearly rather closely related to the latter species. In addition to the immersed chlorocysts, which provide the safest and most consistent differentiating character, the stem hyaloderm cells of *S. magellanicum* frequently have two or more pores in the external wall (two-pored cells are not unknown in *S. perichaetiale*, but they are exceedingly rare and confined to an occasional leucocyst immediately adjacent to the insertion of a stem leaf or branch fascicle).

Typical *S. magellanicum*, where it occurs in temperate latitudes, is a clearly defined taxon having considerable morphological stability. This stability tends to break down with tropical latitudes, but probably not to such a degree that permits ready separation into definable infraspecific taxa in most regions. Nevertheless, there are problems yet to be solved regarding the status and relationships of the African plants of subsp. *grandirete* and other tropical expressions of the species. Subspecies *grandirete* clearly links *S. magellanicum* with the more primitive *S. perichaetiale*, and the Madagascan populations may be relict forms of an early divergence of the two species.

Subgenus *ISOCLADUS*

Sphagnum subgen. ***Isocladus*** (Lindb.) Braithw. in *Mon. microsc. J.* **14**: 48 (1875).
Isocladus Lindb. in *Öfvers. K. VetenskAkad. Förh. Stockh.* **19**: 133 (1862). Type: *Sphagnum macrophyllum* Brid.
Sphagnum subgen. *Litophloea* (Russow) A. Andrews in *Bryologist* **14**: 73 (1911).

Very variable but cortical cells of stems and branches not fibrillose and very rarely endowed with more than a single, unringed pore in the exposed walls; internal walls without large pores. Branch hyaloderm dimorphic, typically with 1–4 much enlarged and often strongly protuberant 'retort cells' with the remaining cells unmodified and eforaminate. Branch leaves rarely with a resorption furrow. Pseudolacunae, if present, poorly developed (only in some species of section *Acutifolia*).

Section *ACUTIFOLIA*

Sphagnum sect. ***Acutifolia*** Wilson, *Bryol. brit.*: 20 (1855), excl. parte. – Schlieph. in *Verh. zool.-bot. Ges. Wien* **15**: 413 (1865). Type: *Sphagnum acutifolium* Schrader = *S. capillifolium* (Ehrh.) Hedw.
Sphagnum sect. *Pycnosphagnum* C. Müll. in *Flora, Jena* **70**: 404 (1887).

Plants usually small to medium-sized; secondary pigments often pronounced, crimson or less commonly orange or brown. Branches markedly dimorphic. Stem hyaloderm well developed, 3–4-layered, the outermost layer often foraminate. Retort cells of branch cortex commonly solitary. Stem leaves usually strongly modified. Branch-leaf leucocysts strongly inflated, mainly dorsiporose in mid-leaf but amphiporose in lower-lateral leaf areas; pores typically large and distinctly ringed. Chlorocysts of branch leaves typically trapezoid in section, always displaced towards, and with wider exposure on the adaxial leaf face.

Absent from Australasia, otherwise with a distribution more or less coincident with that of the genus.

Although this section is one of the most diverse and ecologically important groups in the temperate to subarctic northern hemisphere, it is represented by few tropical taxa, and in Africa appears to be represented almost solely by a single, very variable but widespread species. In this respect, the situation is analogous to that found in the Malaysian flora. However, whereas the Malaysian *S. junghuhnianum* Dozy & Molkenb. is apparently related to *S. subnitens* and its allies, the African *S. violascens* C. Müll. is much closer to *S. russowii* Warnst. and the American species *S. meridense* (Hampe) C. Müll.

3. Sphagnum violascens C. Müll.
(Figs 5–8)

in *Flora, Jena* **70**: 422 (1887). Type: Mozambique, *M.B. de Carvalho* (COI).
S. ericetorum Bescher., *Fl. bryol. Réunion*: 181 (1881), *hom. illeg.* (non *S. ericetorum* Brid., 1806).
S. obtusiusculum Lindb. ex Warnst. in *Hedwigia* **29**: 196, tab. 4 fig. 8, tab. 7 fig. 13 (1890). – *S. obtusiusculum* var. *purpurascens* forma *brachy-dasyclada* Warnst. in *Hedwigia* **29**: 197 (1890). – *S. obtusiusculum* var. *pallescens* Warnst., *Sphagnol. univ.*: 92 (1911).
S. acutifolium Schrader var. *borbonicum* Ren. & Cardot apud Warnst. in *Hedwigia* **29**: 196 (1890), *nom. syn.*
S. purpureum Schimper ex Warnst. in *Hedwigia* **29**: 197, tab. 4 fig. 9, tab. 7 fig. 12 (1890).
S. borbonicum Warnst., *Sammlung europäischen Torfmoose*: 385 (1894); in Ren., *Musci mascareno-madagascarienses exs.* 50 (1892), *nom. nud.*; *Sphagnol. univ.*: 90 (1911), *nom. syn.*
S. cordemoyi Warnst. in *Hedwigia* **36**: 150 (1897).
S. rodriguezii Ren. & Cardot apud Warnst., *Sphagnol. univ.*: 90 (1911), *nom. syn.*
S. scotiae Cardot in *Trans. R. Soc. Edinb.* **48**: 70, plate 1 fig. 1 (1911).
S. laceratum sensu Garside in *Jl S. Afr. Bot.* **15**: 71 (1949) (non *S. laceratum* C. Müll. & Warnst., 1897).

Plants very variable in superficial appearance, small and compact to medium-sized and rather lax, sometimes pale yellowish green but usually with some tint of crimson and, in open habitats, commonly the whole plant deep wine-red. *Fascicles* usually rather closely set but, especially in shade forms, sometimes rather distant, composed of (3–)4–5 branches which are distinctly to

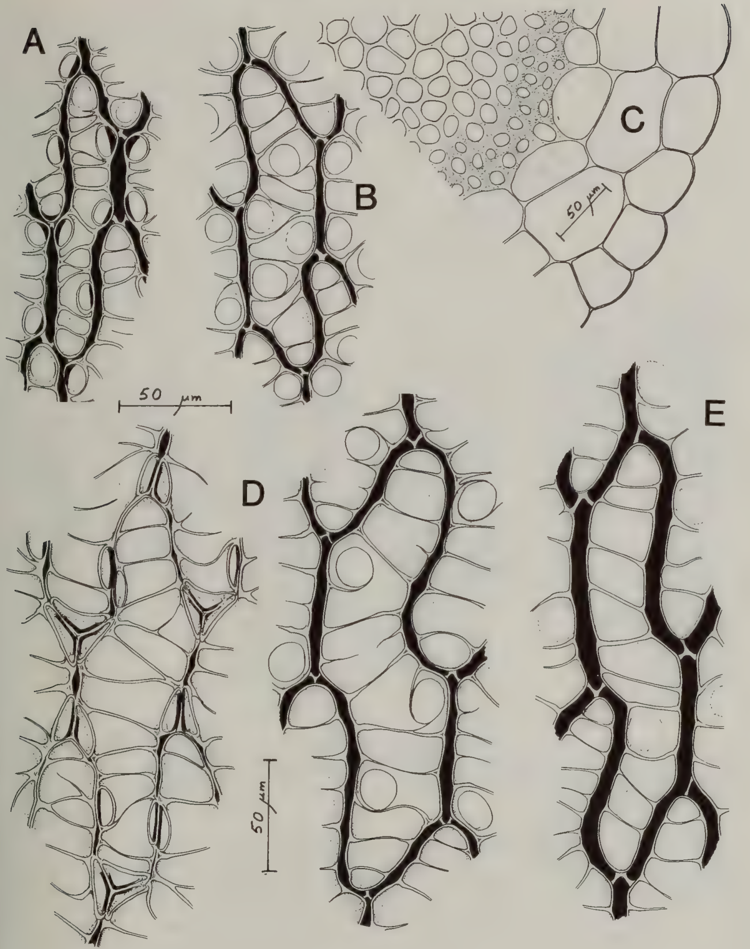

Fig. 5 *Sphagnum violascens* C. Müll. A, adaxial surface of upper part of branch leaf; B. adaxial surface of lower-median part of branch leaf; C, transverse section of stem; D, branch leaves (above) and stem leaf (below); E, abaxial surface of lower median part of branch leaf; F, branch fascicle; G, stem-leaf apex; H, transverse section of branch leaf (a form with non-fibrose stem leaves, drawn from *Descoings* s.n.).

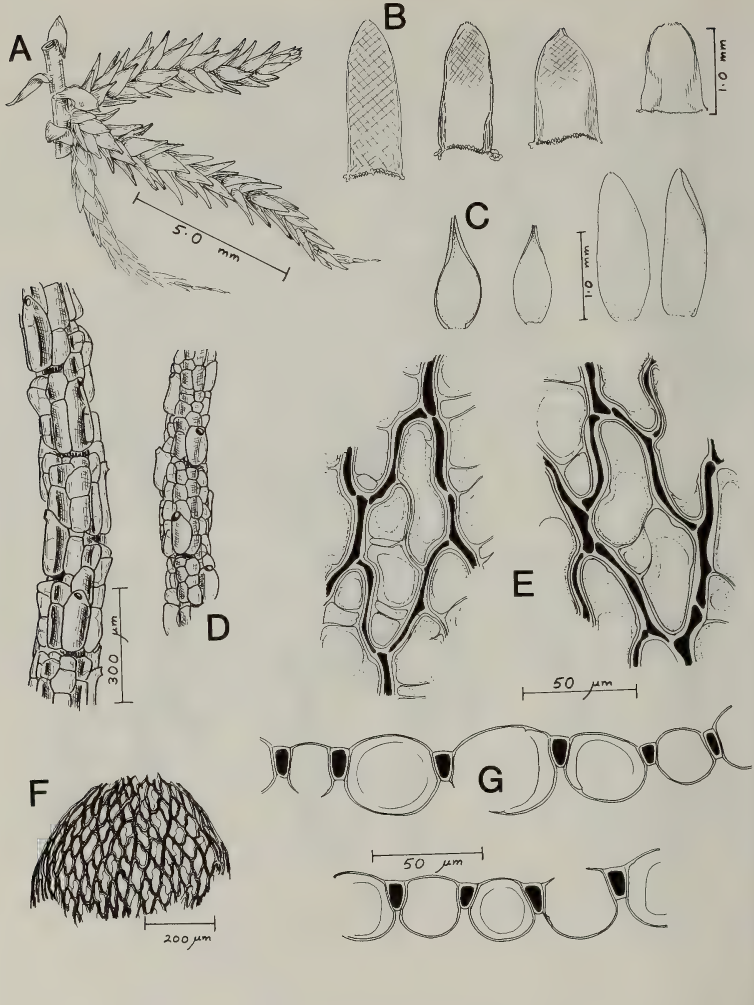

Fig. 6 *Sphagnum violascens* C. Müll. A, branch fascicle; B, stem leaves; C, branch leaves; D, branch cortex; E, abaxial (left) and adaxial (right) surface of stem leaf in weakly fibrillose region; F, apical region of stem leaf; G, transverse sections of branch leaf (A, B, (two at left), D (left), E and G drawn from the type of *S. cordemoyi*; the remainder from various sources).

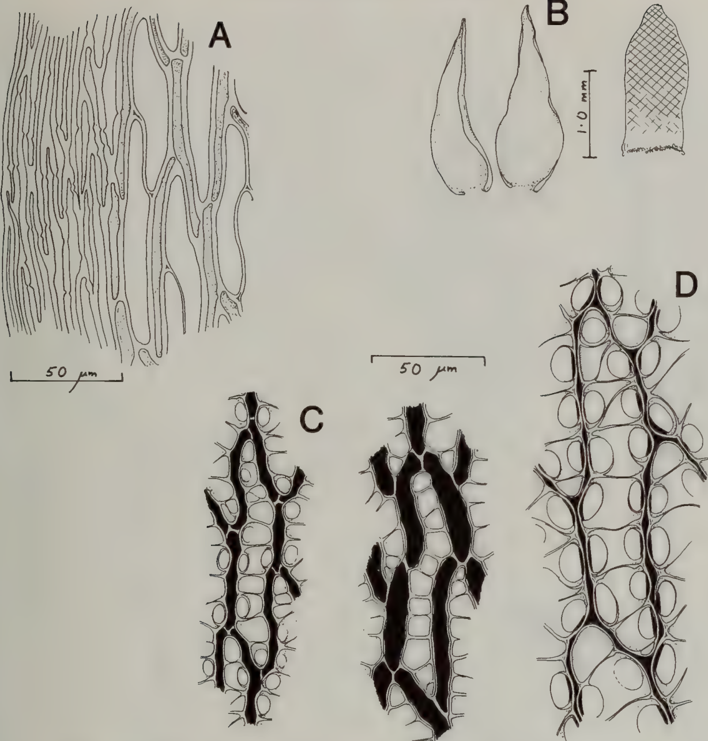

Fig. 7 *Sphagnum violascens* C. Müll. A, lower lateral area of stem leaf; B, branch leaves (left) and stem leaf (right); C, adaxial surface of branch leaf (right) and abaxial surface (left) from sub-apical leaf region; D, abaxial surface of branch leaf from lower-lateral leaf region (B drawn from the type of *S. scotiae*; the remainder from *Guillaumet* 4200).

strongly dimorphic. Spreading branches short or much attenuated, 6·0–20·0 mm long; pendent branches paler, narrow and caudiform, finely tapering, 10·0–25·0 mm. *Stems* 0·6–0·8 mm diameter. Cortex very well developed of (2–)3–4 layers of thin-walled, highly inflated leucocysts, the outer series commonly with solitary pores or thinnings; internal cylinder reddish brown to violet-brown. *Branch cortex* dimorphic, retort cells solitary or in linear pairs (rarely threes). *Stem leaves* lingulate, variable in attitude but mainly erect or erect-spreading 1·3–1·8 mm long, 0·6–0·8 mm wide: apex abruptly narrowed to a broadly truncate, dentate or more or less erose-fimbriate tip, *c.* 150–300 μm wide; border 2–4 cells wide above, distinctly to strongly expanded below. Leucocysts variable; in upper part of leaf varying from strongly to weakly fibrillose, or quite devoid of fibrils, strongly fibrillose tissues more or less identical to those of branch leaves, otherwise largely resorbed adaxially and with few abaxial pores. Septa few to numerous, especially in non-fibrillose states. *Branch leaves* suberect to erect-spreading, unranked or partially to wholly 5-ranked, numerous (60–80 per branch on average) the lower

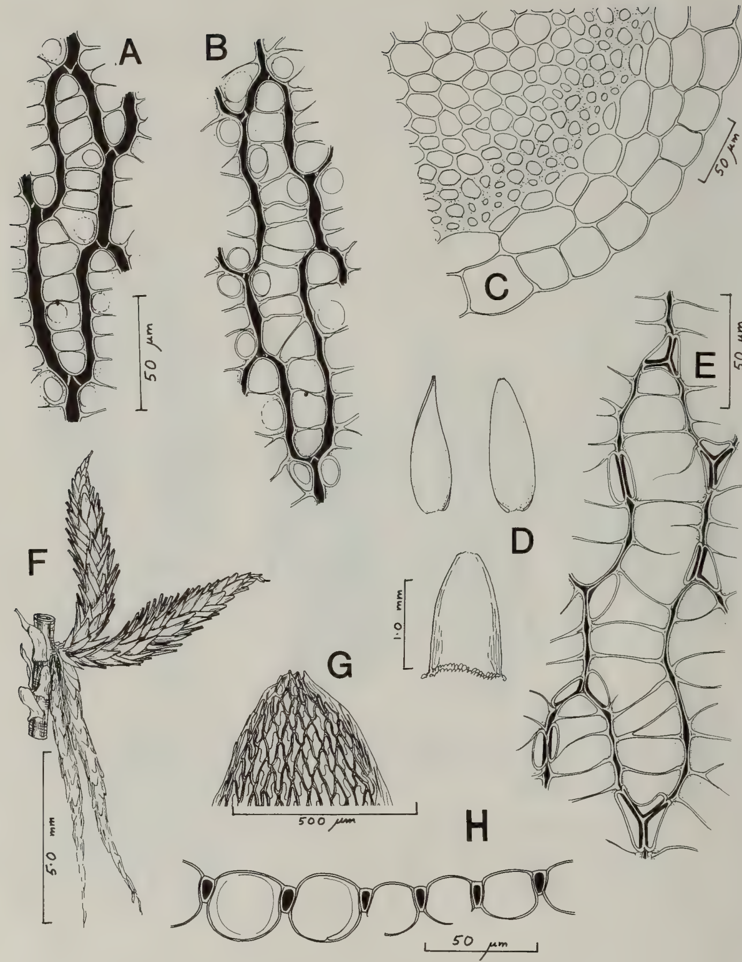

Fig. 8 *Sphagnum violascens* C. Müll. A, adaxial leaf surface from subapical leaf region; B, adaxial leaf surface, mid-leaf; C, transverse section of stem; D, abaxial (left) and adaxial (right) leaf surface, lower mid-leaf; E, adaxial leaf surface, mid-leaf (all drawn from the type of *S. obtusiusculum*).

commonly with sub-tubular apices and appearing more or less acute, the more distal shallowly concave and obviously rounded-truncate, (1·1–)1·3–1·6(–2·0) mm long, 0·6–0·9 mm wide. Border narrow, 1–2 cells wide, without a resorption furrow. Lower pendent-branch leaves similar to distal spreading-branch leaves, becoming narrowly lanceolate and delicate. *Leucocysts* very variable in size, in apical part of leaf about 12·0–20·0 × 70·0–100 μm, becoming progressively larger and up to 35·0 × 200 μm in lower-lateral parts of leaf. Abaxial surface in mid-leaf with 1–5 medium-sized, ringed pores against the commissures, *c.* 8·0–15·0 μm diameter, which tend to form more or less well-defined 'triplets' at the basal angles; apical angle frequently with a large resorption gap. Adaxial surface with or without 1–3 large, median, circular, unringed or thin-ringed pores *c.* 26·0 μm diameter. Leucocysts in lower and lateral parts of leaf with more numerous, large pores on both sides. Leucocysts of pendent-branch leaves with rather more frequent pores but otherwise identical to those of ordinary leaves. *T.S. leaf.* Leucocysts shallowly convex on the adaxial side, much inflated abaxially. Chlorocysts in section trapezoid with much wider exposure on the adaxial side. *Dioecious*? No fertile material seen or reported.

Distribution. Uncommon to rare and of local occurrence in widely scattered localities down the eastern side of the African continent from Mozambique to the Cape region; rather frequent to locally common in the mountains of Madagascar and Réunion. The species is intolerant of long periods of immersion and is to be found on wet, acid soils in open or lightly shaded heathland or scrub vegetation.

Southern Africa. CAPE PROVINCE: Houtbay, *Rehmann* exs. 9b (H); Riversdale, Garcias Pass, *Thorne*, 1926 (PRE); Sonderende, *Wilman* 527 (PRE); River Sonderende Mountains, 4000 ft (1220 m) alt., *Stokoe* 9261 (PRE); Caledon Division, 1000 ft alt., 'by stream, much shaded', *Adamson* s.n. (PRE, herb. BOL no. 24436); mountains above Hermanus, *Vogelpoel* 12794, 12795 (PRE); Fernkloof, above Hermanus, 'in bright red, rounded cushions by stream in fynbos', *Brenan* M. 2783 (PRE); Cape, *Zeyher* s.n. (BM).

Mlanje/Chimanimani. MALAWI: Mt. Mlanje, 2000 m alt., *Wilman* 1369/52 (BM). MOZAMBIQUE: *M.B. de Carvalho* s.n. (COI – holotype of *S. violascens*).

East African Islands. MADAGASCAR: *Pollen & Van Dam* s.n. (BM, H – syntype collections of *S. obtusiusculum*); Plateau d'Ikongo, *Besson* s.n. (PC); Ambohimatrara, Betsileo, *Berthieu* s.n. (PC); Fianarantsoa, forest of Andrambovato, 'on granite in sun', 1000 m alt., abundant,. *Descoings* s.n. (BM); Ambatoloana, 1350 m alt., *Bosser* 16197 (BM); Mt. Tsaratauana, 1200–2400 m alt., *P. de la Bathie* 187 (PC); North of Marojejy, *Guillaumet* 4065, 4186, 4200 (BM, NAM). MAURITIUS: *Bory St. Vincent* s.n. (BM); *Rodriguez* s.n. (BM). RÉUNION: *Cordemoy* s.n. (PC, in herb. Bescherelle – type collection of *S. cordemoyi*), *Richard* 683; Plaine de Mafate, *Rodriguez* s.n. (BM, PC – syntypes of *S. obtusiusculum*), *Bosser* 11137 (BM); Plaine de Palmista, 1400 m alt., *Bory* s.n. (BM); Plaine des Cafres 'thick moss cushion on open grasplain (sic) common', *Schlieben* 877 (PRE); Plaine des Cafres, Mare à Bone, 1584 m alt., *Onraedt* 69.R.0475; North of Fournaise, 1800 m alt., *Gimalac* 71.R.6535; Plaine des Palmistes, 1020 m alt., *Gimalac* 70.R.3507 p.p. (BM, NAM); Plaine des Chicots, 1400 alt., *Onraedt* 71.R.9251 (BM, NAM), *De Sloover* 17256 (BM); Savane Mare à Bone, 1570 m alt., *Onraedt* 73.R.8057 (BM).

S. violascens is in many respects the African analogue of the boreal *S. capillifolium* (Ehrh.) Hedw., to which it bears a strong superficial resemblance. It is equally variable in that it may be a compact, densely branched plant or a lax one, and vary from an intense wine-red colour to pale, straw-coloured or green, with little or none of the secondary crimson pigmentation in evidence. Branch-leaf areolation resembles that of subgenus *Sphagnum*, but the resorption furrow is lacking and the small leaves with truncate-dentate apices are more akin to those of the other sections of subgenus *Isocladus*. The wide leucocysts and large, ringed commissural pores are distinctive, being larger than those of the *S. capense* group (up to 20 μm or more), while the more widely exposed chlorocysts, trapezoid rather than urceolate in section, prevent confusion with *S. ceylonicum*. The stem leaves are very variable, especially in regard to the presence or absence of fibrils. There does not seem to be any correlation between the degree of stem-leaf fibrillation with other morphological features such as intensity of pigmentation or degree of branch leaf ranking, so that there is no logical way in which the species can be meaningfully subdivided into subspecies or varieties.

S. violascens seems to have no close relatives in Africa apart from *S. reichardtii* (see below)

which is probably a vicariad, derivative taxon. On the other hand, *S. capillifolium* and *S. russowii* Warnst. are obviously rather closely related northern species which would be difficult to separate, at times, from the present plant if they were to occur together. *S. violascens* has similar cortical pores and/or thinnings to those of *S. russowii* in the stem hyalodermis, and shows some approach to the latter in the frequent presence of large adaxial branch-leaf pores in mid leaf. Its stem leaves are much less stable in form, and are much narrower across the tips than those of *S. russowii*. The American species, *S. meridense* (Hampe) C. Müll., is also rather close to both *S. violascens* and *S. russowii*, differing from the former most obviously in having proportionately wider leaves furnished with more numerous and rather smaller pores.

The present author's view, that the phylogenetic derivation of *Sphagnum* subgenus *Sphagnum*, is one with direct connections with *Sphagnum* section *Acutifolia*, has been stated already (Eddy, 1977). In addition to certain structural modifications (e.g. the multistratose hyaloderm and highly inflated leucocysts) there are marked similarities in the ecological preferences of the two groups. Neither group contains species that occupy aquatic habitats (with the exception of some boreal, probably derivative species in section *Acutifolia*) but instead contain most of the characteristic 'hummock formers' familiar to temperate-zone ecologists. Perhaps therein lies the explanation why two of the more widespread *Sphagnum* species, one from each group (i.e. *S. perichaetiale* and *S. violascens*), are both absent from the East African afromontane regions, although common in the East African islands, and occur in the Cape region. Assuming former distributions to be more continuous, it is presumed that more ecologically sensitive species have been eliminated from areas in which other taxa managed to survive. Aquatic modes of survival are manifest among taxa of sections *Subsecunda* and *Cuspidata*, both of which are recorded from regions where *S. violascens* and *S. perichaetiale* are unknown.

4. Sphagnum reichardtii Hampe ex Warnst.
(Fig. 9)

in *Hedwigia* **29**: 206, tab. 5 fig. 17, tab. 6 figs 1–3 (1890).
? *S. reichardtii* Hampe in Reichardt in Fenzl, *Reise Novara*, Bot. Theil **1** (3): 166 (1870), *nom. nud.*

Plants lax and pale, apparently poorly developed and modified by habitat, having many reduced stems and regrowths. *Fascicles* potentially with 2 spreading branches and 2 pendent branches up to 16·0 mm long, weakly dimorphic. *Stem* pale to brownish; cortex (1–)2–3-layered, lacking superficial pores. *Branch cortex* dimorphic with 1–2 relatively distinct and slightly protuberant retort cells. *Stem leaves* flaccid, ovate-lingulate, on average 1·7 mm long, 0·85 mm wide, widest at some distance above insertion. Leaf apex truncate and irregularly dentate. Border intact, slightly expanded below. Leaf tissue characteristically multiseptate, each leucocyst subdivided by numerous septa which in many cases are clearly derived from aborted chlorocysts. *Branch leaves* rather thin-textured, lanceolate, up to 2·2 mm long, 0·7 mm wide, apices widely truncate-dentate. *Leucocysts* variable, sometimes identical to those of *S. violascens* but many or the majority aberrant in that they are subdivided by 'septa' like those of the stem leaves. *T.S. leaf.* Chlorocysts rather thin-walled, trapezoid with distinctly wider exposure on the adaxial side.

Distribution. Apparently endemic to St Paul Island.
East African Islands. ST PAUL ISLAND: Monte St Paul, 1100 [m alt. ?], *G. de l'Isle* 17 (Exped. astronom. aux Iles St Paul et d'Amsterdam 1874/75), (PC – type collection).

Section *Acutifolia* is rather poorly represented in the southern hemisphere and in looking for relationships between *S. reichardtii* and other species of the section, *S. junghuhnianum* Dozy & Molkenb. (Malaysia), *S. meridense* (Hampe) C. Müll. (S. America), and *S. violascens* (Africa) are the reasonable possibilities. From a purely geographical standpoint, there seems to be little doubt that *S. reichardtii* derives from the same stock as *S. violascens*. Its claims to specific status are, however, rather more doubtful, and it is maintained as such here mainly because of the lack of more positive evidence of identity with the latter species. Even where *S. violascens* is common, in Madagascar for example, parallel modifications to a '*S. reichardtii*' form have not

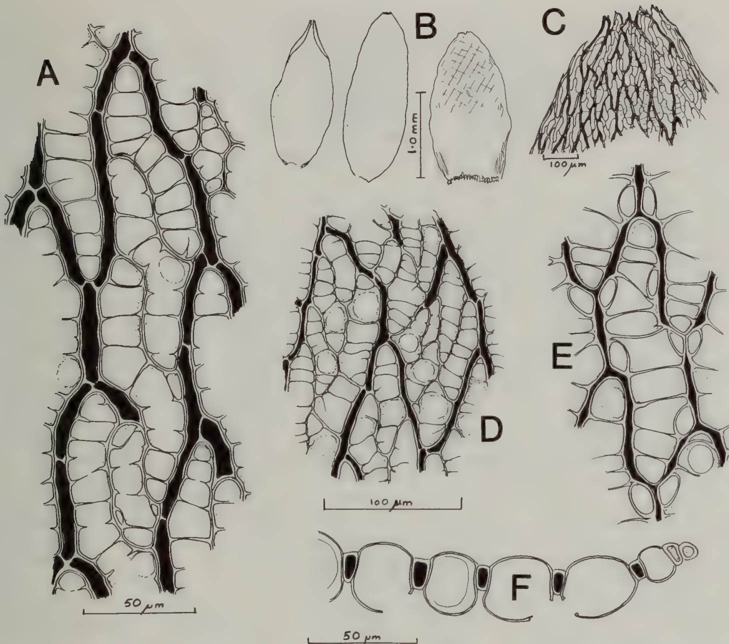

Fig. 9 *Sphagnum reichardtii* Hampe ex Warnst. A, adaxial surface of branch leaf; B, branch leaves (left) and stem leaf (right); C, apical region of stem leaf; D, adaxial surface of stem leaf; E, abaxial surface of branch leaf, unmodified form; F, transverse section of leaf (all drawn from the type).

been collected. In this connection, however, it is interesting to compare the material of *S. scotiae* (= *S. violascens*) from Ascension. It has much the same overall form and structure as *S. reichardtii* (and had, in fact, been subsequently misidentified as *S. cuspidatum*) but lacks the characteristic subdivision of the leucocysts by which the present taxon is distinguished.

Warnstorf's description (1890) of the species is based principally, if not exclusively, on the collection of G. de l'Isle, whereas Hampe's *nomen nudum* pertained to the earlier collections made, presumably by Jelinek and Hochstetter, during the Novara expedition, 1857/59. It appears that the latter material no longer exists.

5. Sphagnum fimbriatum Wilson
(Fig. 10)

in J. D. Hooker, *Crypt. bot. antarct. voy.*: 92 (1845). Type: Falkland Islands, *J. D. Hooker* (BM).

Plants elongate, rather small, green or pale straw-coloured; capitula with more or less conspicuous, projecting stem-buds. *Fascicles* usually rather remote, composed of 4–5 distinctly dimorphic branches: 2(–3) spreading branches elongate, thin, finely tapering, 15·0–20·0 (–30·0) mm long; 2(–3) pendent branches very attenuated, pale, appressed to stems. *Stems* pale, yellowish to very pale brown, 0·7–0·9 mm diameter; cortex well developed, consisting of 2–3

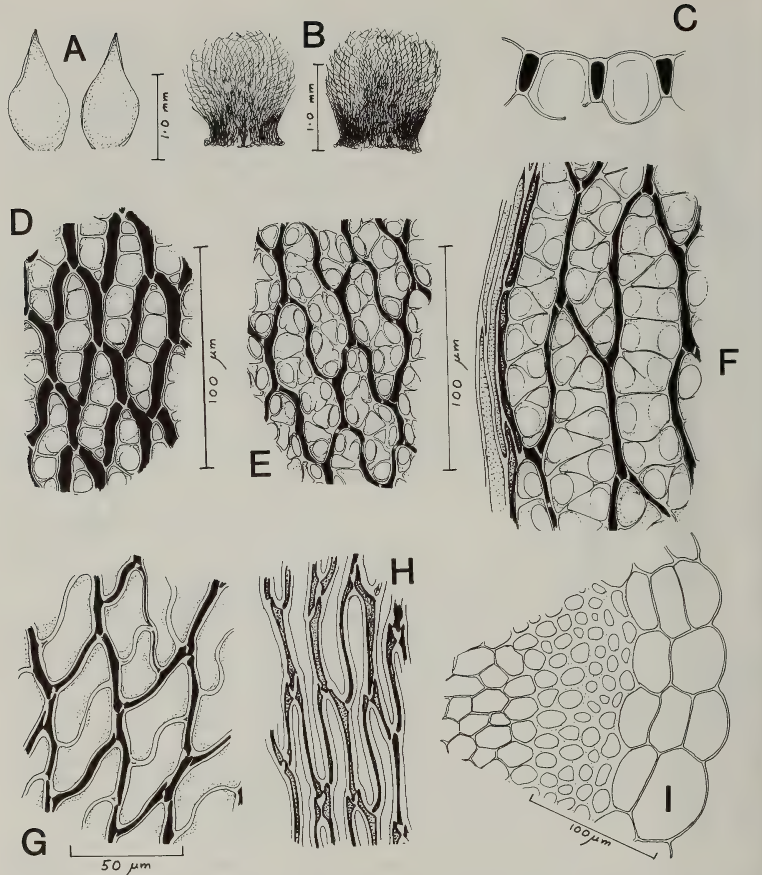

Fig. 10 *Sphagnum fimbriatum* Wilson. A, branch leaves; B, stem leaves; C, transverse section of branch leaf; D, adaxial surface of branch leaf; E, abaxial surface of branch leaf; F, lower lateral region of branch leaf, adaxial side; G, stem leaf tissue, upper mid-leaf; H, stem leaf tissue, lower mid-leaf; I, transverse section of stem (all drawn from *Wager* 1057).

layers of thin-walled leucocysts, the majority of outer cells each having a large pore; internal cylinder yellowish to yellow-brown. *Branch cortex* strongly dimorphic; retort cells solitary or in linear series of 2(–3), slightly protuberant at apertures. *Stem leaves* erect and appressed to stems (therefore virtually invisible in surface view), shortly and broadly spathulate, 0·9–1·4 mm long, 0·9–1·2 mm wide in upper half, delicate in texture, expanded and conspicuously resorbed, fimbriate around the whole apical region; border strongly expanded below into broad patches of

prosenchymatous tissue, evanescent above mid-leaf; leucocysts greatly widened above, devoid of fibrils and largely resorbed on both sides; septa numerous. *Branch leaves* rather small, numerous, erect to erect-spreading, sometimes sub-squarrose, never 5-ranked, more or less lanceolate, (1·1–)1·3–1·5(–1·9) mm long, 0·6–0·8 mm wide; apices truncate and 5–7-dentate; border 2–3 cells wide, without a resorption furrow. *Leucocysts* very variable in size; in upper mid-leaf relatively narrow, 15·0–20·0 × 90·0–120·0 μm, in lower lateral parts of leaf much larger, 20·0–35·0 × 110–200 μm. Abaxial surface with relatively few, medium to large ringed pores mainly in the lower and lateral cell-angles, commonly with a large resorption gap in the apical angle. Adaxial surface occasionally porose, normally with (1–)3–4(–7) large, unringed or thin-ringed pores. Leucocysts of lower-lateral regions of leaf with numerous large circular pores on both sides. Leucocysts of pendent-branch leaves all multiporose; pores very numerous on abaxial surface, large (10·0–20·0 μm), more or less in series along the commissures. *T.S. leaf.* Leucocysts strongly inflated on abaxial side, less so to almost plane on adaxial side. Chlorocysts more or less trapezoid with widest exposure on adaxial side. *Monoecious* (autoecious). Antheridia borne towards distal ends of spreading branches; perigonial bracts yellowish. Inner perichaetial bracts large and convolute, *c.* 4·5–6·0 mm long; apices retuse, not resorbed.

Distribution. Widespread in the temperate northern hemisphere and bipolar in that it also occurs in temperate South America and some subantarctic islands. Known from only a single locality in South Africa where it has possibly been introduced (Magill, 1981: 26).

South Africa. TRANSVAAL: Belfast, *Wager* 1057 (BM, PRE).

At one time, a record of this species from South Africa did not seem to be too unusual, since it has a bipolar distribution. Many antarctic bryophytes that occur in Australasia and temperate South America have also been found in South Africa, and there did not appear to be any logical reason why *Sphagnum* should not share this pattern of distribution. However, no other antarctic *Sphagnum*, even the widely distributed *S. falcatulum* Bescher., has been found in southern Africa. Furthermore, a species of such fecundity and ecological tolerance as *S. fimbriatum* had it survived in the region at all, should surely be more widespread than the solitary record indicates. The suggestion of Magill (1981) that the species might have been introduced is therefore given considerable support. Personal experience has shown that *S. fimbriatum* can, with ease, be successfully cultivated in Britain, and fertile plants readily produced.

Section *SUBSECUNDA*

Sphagnum sect. ***Subsecunda*** (Lindb.) Schimper, *Syn. musc. eur.* 2nd ed.: 843 (1876). Type: *Sphagnum subsecundum* Nees

A large and heterogeneous group that owes its recognition mainly to an absence of secondary evolutionary characters. It contains taxa that appear to be relatively primitive, but also some that connect with section *Acutifolia* and section *Cuspidata*.

Subsection *SUBSECUNDA*

Variable but mainly rather large, often flaccid plants, with monomorphic or only weakly dimorphic branches. Stem hyalodermis thin, clearly defined, of 1(–3) layers. Branch hyalodermis sometimes only weakly dimorphic (especially in lower parts of branches), with only slightly protuberant retort cells. Stem leaves usually smaller than branch leaves. Branch-leaf leucocysts usually long and narrow with very small, usually thick-ringed pores (commonly under 6·0 μm diameter) scattered or in series along the commissures (free central pores not common).

6. Sphagnum auriculatum Schimper
(Fig. 11)

in *Mém. prés. div. Sav. Acad. Sci. Inst. Fr.* **15**: 80, tab. 24 (1857).
S. contortum Schimper var. *algerianum* (Cardot) Warnst. in *Flora, Jena* **67**: 601 (1884).

Plants medium-sized, green overlaid with brownish and purplish pigments. *Fascicles* rather

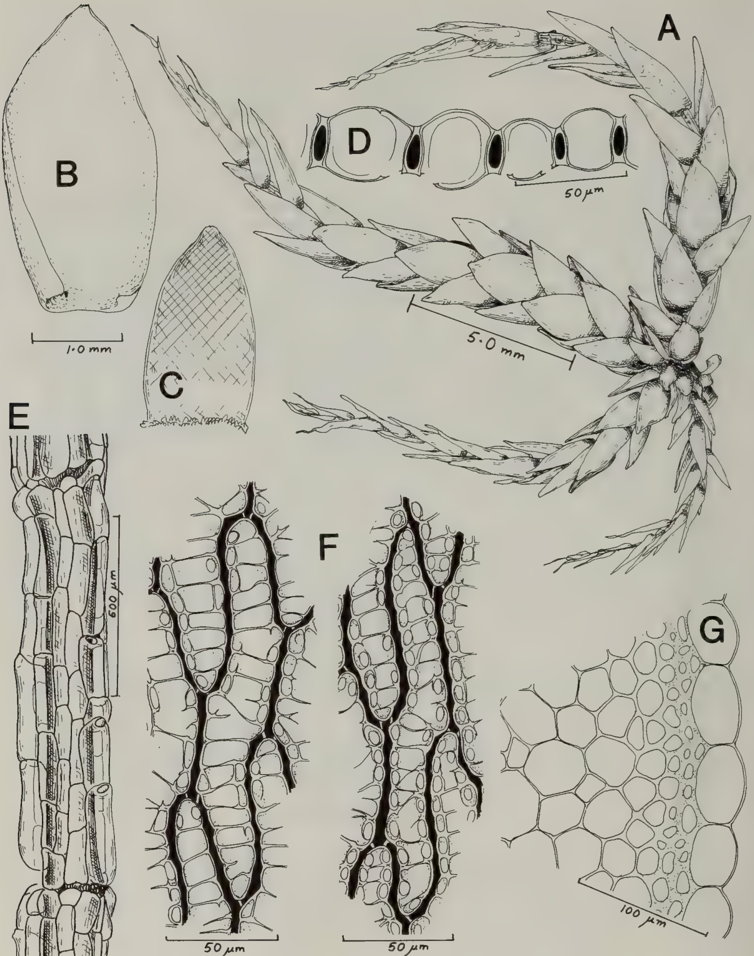

Fig. 11 *Sphagnum auriculatum* Schimper. A, branch fascicle; B, branch leaf; C, stem leaf; D, transverse section of branch leaf; E, branch cortex; F, adaxial (left) and abaxial (right) surfaces of branch leaf; G, transverse section of stem (all drawn from *Cosson* et al., Tunisia).

closely set or well spaced, composed of 3–4 more or less monomorphic branches, the weaker branches paler and more or less pendent. Branches tumid, sometimes curved and cornute, up to 20·0 mm long. *Stems* 0·6–0·8 mm diameter; hyaloderm of a single layer of thin-walled, non-porose leucocysts; internal cylinder pale brown to dark brown. *Branch cortex* indistinctly dimorphic or, near bases of stronger branches, without differentiated retort cells; retort cells otherwise in groups of 2–4, not protuberant at apices. *Stem leaves* lingulate to spathulate, fibrillose in the upper half or beyond the middle; upper fibrillose tissues identical to branch-leaf tissues; septa few, leaf apices concave, erose-dentate; border narrow 2–3 cells wide, not expanded below. *Branch leaves* incumbent, weakly and inconspicuously 5-ranked, concave, broadly ovate; apices truncate and *c.* 5–8-dentate; border 2 cells wide, without a resorption furrow. *Leucocysts* proportionately narrow, 14·0–18·0(–22·0) μm wide, (90–)110–150 μm long in mid leaf. Abaxial surface with numerous to abundant, small, ringed pores *c.* 2·0–4·0 μm diameter, in series along the commissures; free central pores absent or very rare. Adaxial surface with few or no pores. *T.S. leaf*. Chlorocysts more or less barrel-shaped to ovate-rectangular, with oval lumina and thickened walls, more or less median but with a distinct tendency to be more widely exposed on the abaxial side. *Dioecious*. Perigonial leaves typically orange-brown. Inner perichaetial bracts 4·0–4·5 mm long, convolute, fibrillose in the upper 1/3–1/2. Fruit unknown in Africa, frequent in Europe. Spores *c.* 32–34 μm , coarsely papillose.

Distribution. A circumboreal species, very widespread and locally abundant in Europe; confined, in Africa, to mountain ranges in Tunisia and Algeria, unrecorded south of the Sahara.

North Africa. TUNISIA: Kroumiria orientale, Bab-Abúk, *Cosson, Barratte & Duval* s.n. (BM, H, as *S. rufescens*).

The description above is based on the few available collections of *S. auriculatum* from northern Africa, and does not take into account the extreme range of forms that occur in its European populations. As represented in African collections, the plant diverges very little from Schimper's type and fits very well the author's impression of an 'average' sample of the taxon. *S. auriculatum* is very close, phylogenetically, to *S. truncatum*, the main difference lying in the slight, but reasonably consistent, structural difference in the stem leaves and, in the case of *S. truncatum* var. *truncatum*, the branch leaves. *S. truncatum* var. *oligodon*, which is superficially indistinguishable from *S. auriculatum*, has stem leaves which are fibrillose to the insertion, and a high proportion of leucocysts which are septate. *S. truncatum* var. *truncatum* has in general proportionately narrower, more widely truncated and abaxially less porose branch leaves.

Under other circumstances, such small morphological differences might seem to provide inadequate foundations upon which to maintain separate species. However, the ecological barrier of the Sahara Desert and associated arid zones has prevented any possibility of introgression and it is convenient, if not perhaps taxonomically consistent, to maintain *S. auriculatum* and *S. truncatum* at species level.

The earliest valid name for this species has yet to be finally established. For example, *S. lescurii* Sulliv. antedates *S. auriculatum* by a couple of years. However, there is at least one earlier contender in the field (*S. denticulatum* Brid., Isoviita, pers. comm.) and this author adheres to the familiar binomial until the nomenclatural tangle, unimportant as regards African sphagnology, has been finally resolved.

7. **Sphagnum truncatum** Hornsch.
(Figs 12–15)

in *Linnaea* **15**: 114 (1841). Type: S. Africa, Dutoitskloofberge, 3000 ft., *Drège* s.n. (BM – isotype).

S. coronatum C. Müll. in *Flora, Jena* **70**: 412 (1887). – *S. coronatum* var. *cuspidatum* Rehmann in Warnst. in *Hedwigia* **29**: 184 (1890). – *S. coronatum* var. *falcatum* C. Müll. ex Warnst., Sphagnol. univ.: 306 (1911). – *S. coronatum* var. *fluctuans* Rehmann in Dixon & Gepp in *Bull. misc. Inf. R. bot. Gdns, Kew* **19**: 195 (1923), *nom. nud.*

S. fluctuans C. Müll. in *Flora, Jena* **70**: 414 (1887).

S. convolutum Warnst. in *Hedwigia* **29**: 220, tab. 8 figs 10–12, tab. 10 fig. 6 (1890).

S. cuspidatum Hoffm. var. *latetruncatum* Warnst. in *Hedwigia* **29**: 220 (1890), *nom. syn.*

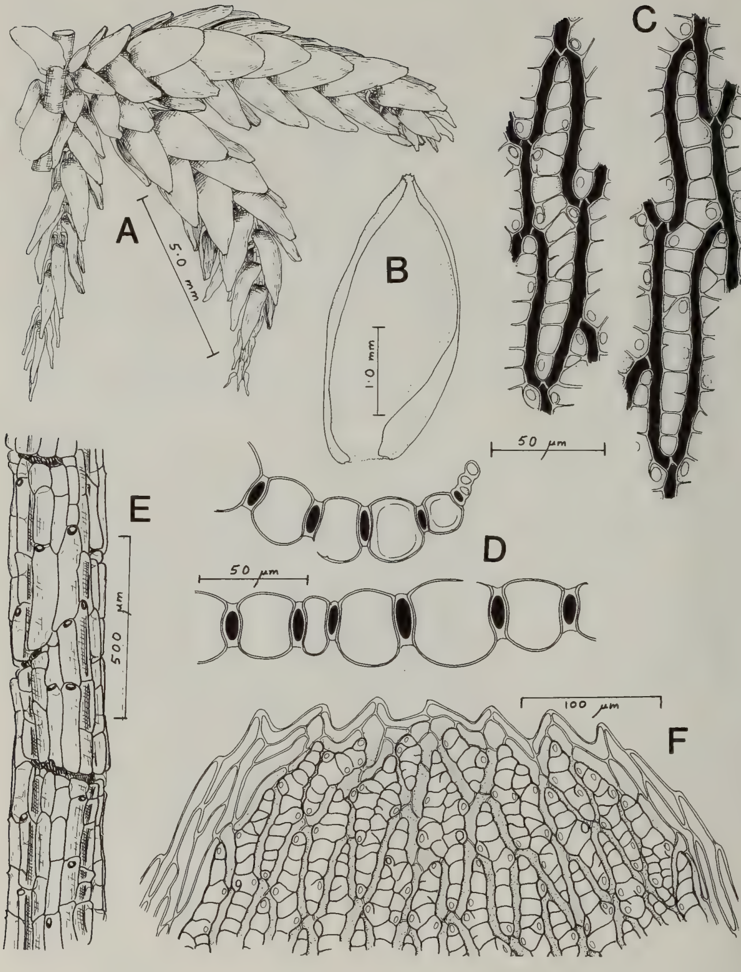

Fig. 12 *Sphagnum truncatum* Hornsch. var. *truncatum*. A, branch fascicle; B, branch leaf; C, adaxial (left) and adaxial (right) surfaces of branch leaf; D, transverse section of leaf; E, branch cortex; F, apex of branch leaf (all drawn from *Werdermann & Oberdieck* 534).

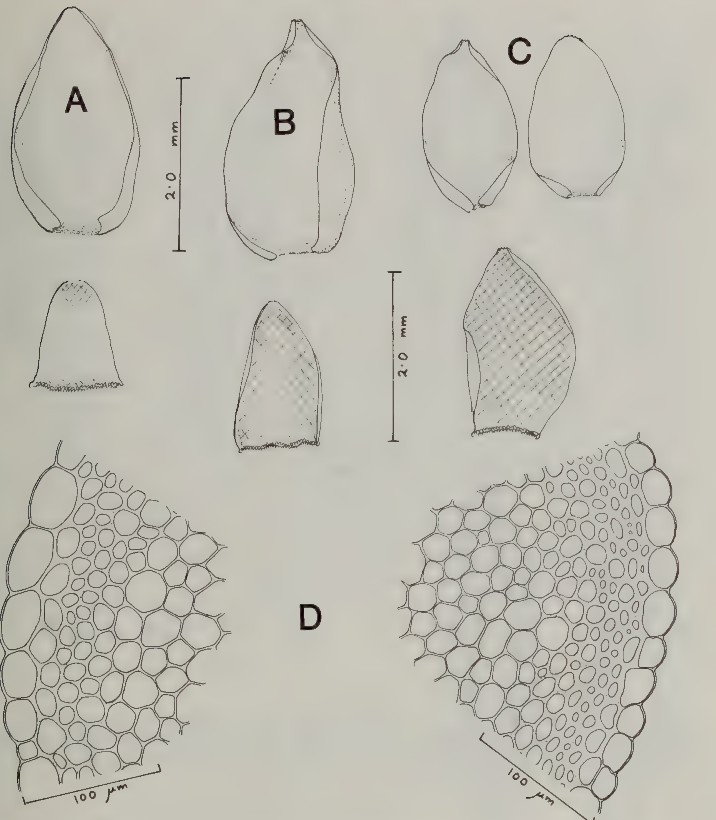

Fig. 13 *Sphagnum truncatum* Hornsch. A–C, branch leaves (above) and stem leaves (below) showing variation in dimensions and degree of isophylly; D, transverse sections of stems. (A drawn from *Rehmann* 9; B from the type collection of *S. oligodon*; C from *Drège* s.n.; D (left) from *Mauve* 5179 and (right) *Eddy* s.n.).

S. hypnoides Schimper ex Warnst. in *Hedwigia* **29**: 220 (1890), *nom. syn.*
S. oxycladum Warnst. in *Hedwigia* **30**: 15, tab. 1 fig. 1, tab. 4 fig. a (1891).
S. rehmannii Warnst. in *Hedwigia* **30**: 16, tab. 1 fig. 2, tab. 4 fig. b (1891).
S. marginatum Schimper ex Warnst. in *Hedwigia* **30**: 28, tab. 2 fig. 20, tab. 4 fig. o (1891). – *S. marginatum* var. *convolutum* (Warnst.) Warnst., *Sphagnol. univ.*: 309 (1911).
S. transvaaliense C. Müll. in Warnst. in *Hedwigia* **30**: 32, tab. 2 fig. 22, tab. 5 fig. q (1891).

Plants extremely variable, flaccid to semi-rigid, medium-sized to rather large, pale green, deep green to yellow-green, with or without orange, brown or, rarely, purple-brown secondary

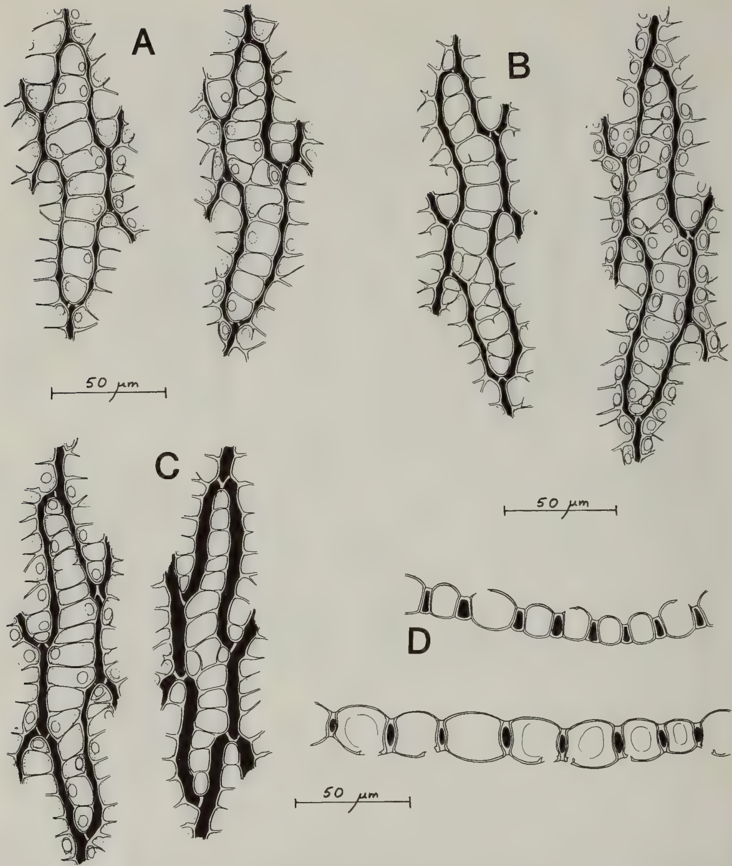

Fig. 14 A and D (upper fig.) *Sphagnum truncatum* Hornsch. var. *truncatum*. A, abaxial (right) and adaxial (left) surfaces of branch leaf; D, (above) transverse section of leaf. B–D (lower fig.) *S. truncatum* var. *bordasii* (Bescher.) A. Eddy. B, adaxial (left) and abaxial (right) surface of branch leaf; C, adaxial (right) and abaxial (left) surface of branch leaf; D, (below) transverse section of leaf (A, D drawn from *Rankin* 342; B–D from the type collection of *S. mathieui*).

pigmentation. *Fascicles* closely set to remote, composed of 2–4, rarely 5 branches which are only slightly or not at all dimorphic. Branches abbreviated and tumid to elongated, flaccid and long-tapering, (6·0–)10·0–20·0(–35·0) mm long. *Stems* normally brown, at least in part, but pale in etiolated states, 0·5–0·9 mm diameter. Cortex distinct, of basically a single layer of leucocysts; sometimes with irregular duplication but never more than 25 per cent bistratose. Cortical pores absent or rarely present but very faint. Internal cylinder weak or strong, typically brown.

Branch cortex indistinctly dimorphic. Retort cells often indistinguishable from other cortical cells, especially towards base of branch, then many or all cortical cells uniporose; when distinct, retort cells in linear series of 2–4, not or very slightly protuberant at apertures. *Stem leaves* medium to large, 1·4–2·8 mm long, erect, spreading or more or less reflexed, lingulate, spathulate to ovate-spathulate, fibrillose in the upper half, at least, and usually almost, or quite to insertion. Hyaline cells commonly septate, in extreme forms with several septa per leucocyst, in the upper half of leaf porose, the number and distribution of pores more or less as in branch leaves. Apex variable: broadly truncate-dentate or partially resorbed and eroded. Border narrow, 2–4 cells wide, not expanded below. *Branch leaves* large, relatively few per branch (i.e. 30–40 fully developed leaves, on average, compared to at least 40 in most species), basically, but usually not obviously, 5-ranked. Leaves more or less uniform, or distal leaves longer and narrower than lower leaves; very concave and more or less cochleariform, ovate, ovate-lanceolate to more or less linear-lanceolate (distal leaves); 1·6–3·0 mm long. Apex broadly truncate-dentate, sometimes very conspicuously so; border (1–)2 cells wide, without resorption furrow. *Leucocysts* long and narrow to moderately wide, 20·0–30·0(–35·0) μm wide, 110–160 μm long in upper mid leaf. Abaxial surface with few to very numerous, small, mainly ringed pores, 2·0–4·0(–6·0) μm diameter, scattered or in series along the commissures. Adaxial surface equally variable, with few to abundant pores, sometimes with more abundant adaxial than abaxial pores. *T.S. leaf.* Leucocysts more or less equally biconvex or with perceptibly more inflated adaxial sides. Chlorocysts thick-walled and more or less barrel-shaped with oval lumina, varying to rather thin-walled and more or less rectangular with oval-rectangular lumina, 5·0–8·0 μm wide, exposed more or less equally on both sides or with slightly wider abaxial exposure. *Dioecious.* Male plants virtually indistinguishable from sterile plants, apparently very rare. Female plants rarely collected, inner perichaetial leaves very large, 4·8–5·5 μm long, convolute; apices not resorbed, obtuse to minutely retuse; tissues fibrillose above, efibrose towards insertion. Fruit rarely seen; spores *c.* 35·0 μm, rugulose-papillose.

Distribution. From East Africa and the East African islands southwards to the Cape of Good Hope. On irrigated, acid, mineral, or organic substrates from medium to high altitudes. See under varieties below.

7a. Sphagnum truncatum var. truncatum
(Figs 12 & 14)

Plants usually soft or flaccid, rather large unless etiolated. *Branch leaves* often very widely ovate and concave in lower parts of branches, but at least the median and upper leaves less concave, ovate-lanceolate to lanceolate; apices conspicuously truncate and 8–15-dentate. *Leucocysts* with few to several but not abundant nor serial pores on the abaxial side and commonly with more numerous pores on the adaxial side. *Stem leaves* generally fibrillose to insertion, more or less isophyllous and generally with few or no septa.

Distribution. Southern Africa: locally frequent from the western Cape to Transvaal and southern Mozambique; absent further north except for a single record from Zaire/Rwanda. This taxon, as far as collectors' annotations indicate, is nearly always found in habitats which are permanently wet, and at least a third of the specimens examined were partly or completely submerged in acidic mires or streams.

Southern Africa. CAPE PROVINCE: Dutoits kloof, 3000 ft alt., *Drège* s.n. (BM – isotype of *S. truncatum*); Tafelberges [Table Mt.], *MacOwan* s.n. (PC – type collection of *S. convolutum*); Montagu Pass, *Rehmann* 9 (BM, H-SOL – isotypes of *S. coronatum*); Mountains above Worcester, *Rehmann* 10 (BM, H – isotypes of *S. oxycladum*); Sonderend, *Breutel* s.n. (BM, PC – isotypes of *S. marginatum*); Gnadenthal, 'in aquis fluitantib.', *Breutel* 2 (BM – holotype of *S. fluctuans*); Giftberg, *Werdermann & Oberdieck* 534 (BM); Rustenberg, Retrifs Kloof, *Putherill* 11035 (PRE); Table Mt., Kasteels Poort, *Pillans* 4282 (BM); S.W. Cape, Groot Winterhoek, *Osrien* 34 (PRE); Fransch Hoek Pass, *Schelpe* 3878 (BM); Kirstenbosch, *Schelpe* 3857 (BM); Sandown Bay 'open wet slope below 1000 ft' alt., *Levyns* s.n. (PRE-BOL no. 24066); Bain's Kloof, *Wilman* 226 (BM); Kasteel's Ravine, 'sub-aquatic, 2300 ft alt.',

Esterhuysen 15970 (BM); Hex River Valley, 'in running water', *Esterhuysen* 15867 (BM); Stellenbosch, Jonkers Hoek, *Garside* 74 (BM); Table Mt., *Wager* 11, 533 (BM); several collections from Table Mt. and adjacent regions, including *Rehmann* 72, 294, *Sim* 9299. NATAL/KWAZULU: Umpumula, *Ellen* s.n. (BM); Port St John, *Wager* 1091 (BM). TRANSVAAL: Lydenberg, *Wilms* s.n. (BM – isotype of *S. transvaaliense*); Pure Krans, *Mauve* 5179 (PRE); Drakensberg, Graskop, submerged in water, *Rankin* 120, 342, 343 (BM); Pietersberg, *Codd & Dyer* 9147 (PRE); Waterberg, *Germishuizen* 943 (PRE); Belfast, *Wager* 866 (BM). S. MOZAMBIQUE: Lourenço Marques, *Balsinhas* 1341 (PRE).

7b. **Sphagnum truncatum** var. **bordasii** (Bescher.) A. Eddy, **comb. nov.** (Fig. 15)

S. bordasii Bescher. in *Annls Sci. nat.* (Bot.) VI, **10**: 330 (1880). Type: Mauritius, *Bordas* (1879), (PC – holotype, BM – isotype).

S. oligodon Rehmann ex C. Müll. in *Flora, Jena* **70**: 412 (1887). – *S. oligodon* var. *beyrichii* Warnst., *Sphagnol. univ.*: 364 (1911). – *S. oligodon* var. *bachmannii* Warnst., *Sphagnol. univ.*: 363 (1911).

S. mathieui Warnst. in *Bull. Soc. r. bot. Belg.* **41** (1): 7 (1905).

S. mauritianum Warnst. *sensu* Warnst., *Sphagnol. univ.*: 306 (1911), *nom. illeg.*, non *S. mauritianum* Warnst. (1891). – *S. oxycladum* Warnst. var. *mauritianum* (Warnst.) Warnst., *Sphagnol. univ.*: 306 (1911).

S. eschowense Warnst., *Sphagnol. univ.*: 328, fig. 36d, fig. 52D (1911).

Plants robust and often rather compact with tumid branches. *Branch leaves* all broad, very concave, broadly ovate; apices truncate but less conspicuously so (mainly because of the incurved upper leaf margins), 7–11-dentate. *Leucocysts* with numerous, more or less serial pores along the commissures on the abaxial side; adaxial side variable, typically with few pores, occasionally several, rarely with adaxial pores outnumbering the abaxial ones. *Stem leaves* rather short, lingulate to ovate-lingulate, rarely triangular-lingulate, usually abundantly and conspicuously septate. Apices dentate or rather cucullate and eroded.

Distribution. Southern Africa, southern Ruwenzori (Zaire/Rwanda), and the East African islands. Generally more northern and eastern in range than the type variety, but overlapping the range of the latter in southern Africa. Most records indicate a preference for acid mires, but the plant is rarely, if ever, completely submerged.

Southern Africa. NATAL/KWAZULU: Eschowe, 600m alt., *Hankon fils* s.n. (H, PC – isotypes of *S. eschowense*); Inanda, *Rehmann* 14 (BM – isotype of *S. oligodon*); *Wager* 580 (BM). PONDOLAND (= TRANSKEI): *Bachmann* 5 (BM – H, type collections of *S. oligodon* var. *bachmannii*); *Beyrich* 25 (H – isotype of *S. oligodon* var. *beyrichii*). TRANSVAAL: 'in monte Kwatlamba . . .', *MacLea* s.n. (H – isotype of *S. rehmannii*); Kaapsche Hoop, *Wager* 319 (BM).

Ruwenzori/Usambara. BURUNDI: 'tourbière d'Ijenda', 1950 m alt., *De Sloover* 19/179 (BM, NAM).

East African Islands. MADAGASCAR: Moroansitra, *Mathieu* s.n. (PC – type collection of *S. mathieui*). MAURITIUS: *Bordas* s.n. (BM, PC – type collections of *S. bordasii*); between Savondronina and Ramamasana, *Besson* (PC). RÉUNION: *Bosser* 9492 (PC).

S. truncatum is very closely related to *S. auriculatum* Schimper and, indeed, some forms of the former species could pass unremarked among collections of the latter if the two species ever occurred together. Fortunately, the Sahara and surrounding arid zones have proven to be an effective barrier to the transmigration of either species so that, although morphological differences are slight, identification is relatively easy. *S. truncatum* var. *truncatum* is the more divergent form, and has more widely truncated branch leaves than *S. auriculatum*; *S. truncatum* var. *bordasii* has more extensively fibrillose and septate stem-leaf leucocysts than otherwise similar states of the latter species. *S. rutenbergii*, endemic to the East African islands, also comes very close to *S. truncatum* and may be difficult, at times, to separate from that species. It differs in its basically 2-layered stem cortex (never less than 60 per cent 2–3-layered in fully developed plants, in contrast to never more than 20 per cent 2-layered in *S. truncatum*), narrower branch-leaf chlorocysts (*c.* 3·0–4·0 μm, against 4·0–6·0 μm or more in *S. truncatum*), and very weakly developed secondary pigments. *S. africanum* differs in its eroded, rounded branch-leaf apices and, typically, adaxially immersed chlorocysts. Free midline pores are common in typical *S. africanum*, but absent or very rare in the leaf leucocysts of *S. truncatum*.

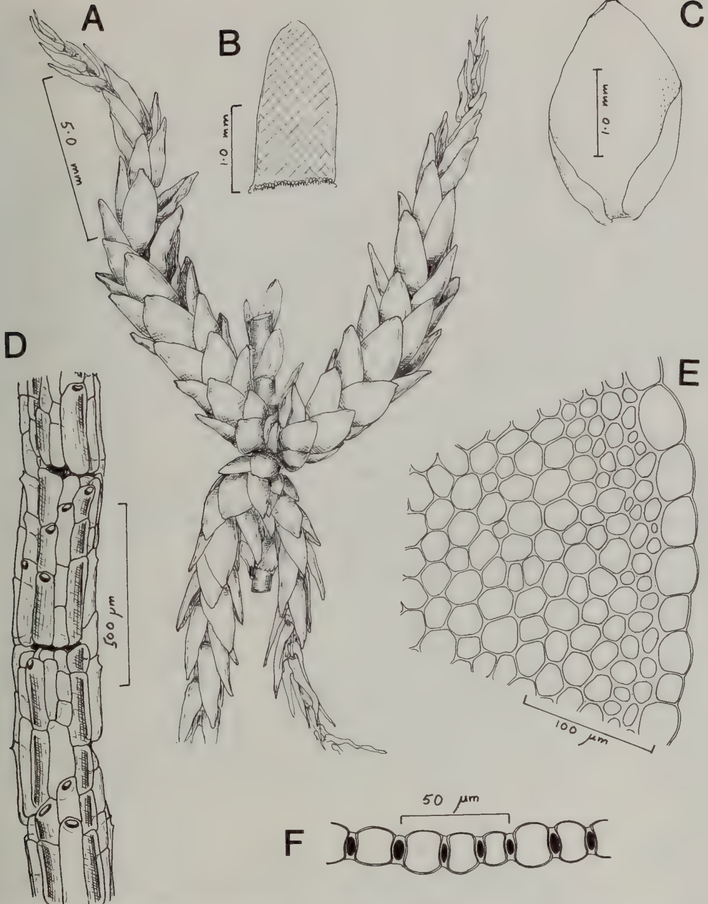

Fig. 15 *Sphagnum truncatum* Hornsch. var. *bordasii* (Bescher.) A. Eddy. A, branch fascicle; B, stem leaf; C, branch leaf; D, branch cortex; E, transverse section of stem; F, transverse section of branch leaf (drawn from the type of *S. bordasii*).

The rather large number of synonyms of *S. truncatum* reflects, not only the relatively wide range and frequency of the taxon, but also its unusually high degree of polymorphism. In this the species parallels the protean qualities of its closest relative, the boreal *S. auriculatum*. The situation is well exemplified by the extremes treated here as the varieties *S. truncatum* var. *truncatum* and *S. truncatum* var. *bordasii*, which may be considered to be analogous to the

'*crassicladum*' and '*auriculatum*' expressions of *S. auriculatum sens. lat.* in Europe. It is emphasized that the two varieties described above are connected by a range of forms that is virtually a cline, and that the division of the species into two varieties is an arbitrary measure that yields a simplistic picture. While recognition of the major variants is felt to be desirable, further subdivision would have to take into account a great number of apparently random and inconstant morphological details.

In ecological behaviour as well as in morphological details, *S. truncatum* is extremely close to *S. auriculatum*. Under different circumstances, it would be tempting to reduce the species to subordinate rank, i.e. at subspecies, to the latter species. However, there are certain drawbacks to this approach. *S. auriculatum* has not been recorded from any other part of the southern (i.e. Gondwanan) hemisphere, which means that its occurrence in Africa, if not a relic of a Gondwanan element, would have to be a more recent incursion from the Laurasian flora. If the latter were true, bearing in mind that modern geologists are agreed that no land connection existed between Africa and Laurasia until the closure of the Tethys around about the mid-Miocene, then *S. truncatum* could surely only have attained its present range and polymorphism after many generations of vigorous outbreeding and successful colonisation. If this were the case, then it is difficult to reconcile such theoretical past performance with its present, apparently almost universal sterility. Many of the variants appear to be very local in occurrence, consistent with mainly vegetative propagation. Whether or not such variants are given varietal names is largely a matter of choice (in some ways, they might be equated with the 'microspecies' of apomictic phanerogams), but it is clear that *S. truncatum*, as a species, exhibits the characteristics of an ancient relic rather than an expanding colonist.

Some tropical American taxa are undoubtedly closely related to *S. truncatum*, but their precise relationships are not yet resolved. For example, the Brazilian species *S. cucullatum* Warnst. seems to be scarcely distinct, and other described taxa no doubt exist. Final resolution of the systematic positions of *S. truncatum, S. auriculatum,* and *S. rutenbergii* in relation to one another, and to the American plants, may have to depend ultimately on biosystematic and chemotaxonomic investigations.

The almost endemic southern African range of *S. truncatum* var. *truncatum*, in contrast to the overlapping but basically northern and eastern range of *S. truncatum* var. *bordasii*, could support their separation at a level above 'variety'. It would be comparatively simple to enumerate characters which easily separate East African island from aquatic southern African forms. However, variation in the various characters is virtually random among southern populations, and ecological data, where available, indicate that '*truncatum*' characters, while not necessarily produced entirely by, are nevertheless much exaggerated by, an aquatic mode of existence. Similarly, subaerial habitats with high atmospheric humidity seem to encourage the development of the '*bordasii*' facies. It is admitted, however, that cultivation experiments on a collection of *S. truncatum* var. *truncatum* (*Rankin* 342) were only marginally successful, and to date no unequivocal '*truncatum*' forms have been found among Madagascan collections.

8. Sphagnum rutenbergii C. Müll.
(Figs 16–19)

in *Abh. naturw. Ver. Bremen* 7: 203 (1881). Type: Madagascar, Forest of Ambatondrazaka, *Rutenberg* (1877) (B, destroyed). Neotype: Madagascar, Imerina, mixed with *S. hildebrandtii* and *S. madegassum, Hildebrandt* (1880) (BM, PC).

S. aequifolium Warnst. in *Hedwigia* **30**: 22, tab. 1 fig. 9, tab. 4 fig. i (1891).

S. mauritianum Warnst. in *Hedwigia* **30**: 17, tab. 1 fig. 3, tab. 4 fig. c (1891), non *S. mauritianum* Warnst. *sensu* Warnst., *Sphagnol. univ.*: 203 (1911).

S. obovatum Warnst. in *Hedwigia* **30**: 18, tab. 1. fig. 4, tab. 4 fig. d (1891).

S. pallidum Warnst. in *Hedwigia* **30**: 170, tab. 19 fig. 30, tab. 24 fig. n (1891).

S. salvanii Warnst. in *Hedwigia* **47**: 119 (1908).

S. flavirameum C. Müll. ex Warnst., *Sphagnol. univ.*: 381 (1911), *nom. syn.*

Plants medium-sized (resembling pale forms of *S. truncatum*) whitish green, with or without tinges of pale brown or yellowish brown. *Fascicles* distant or closely packed, composed of

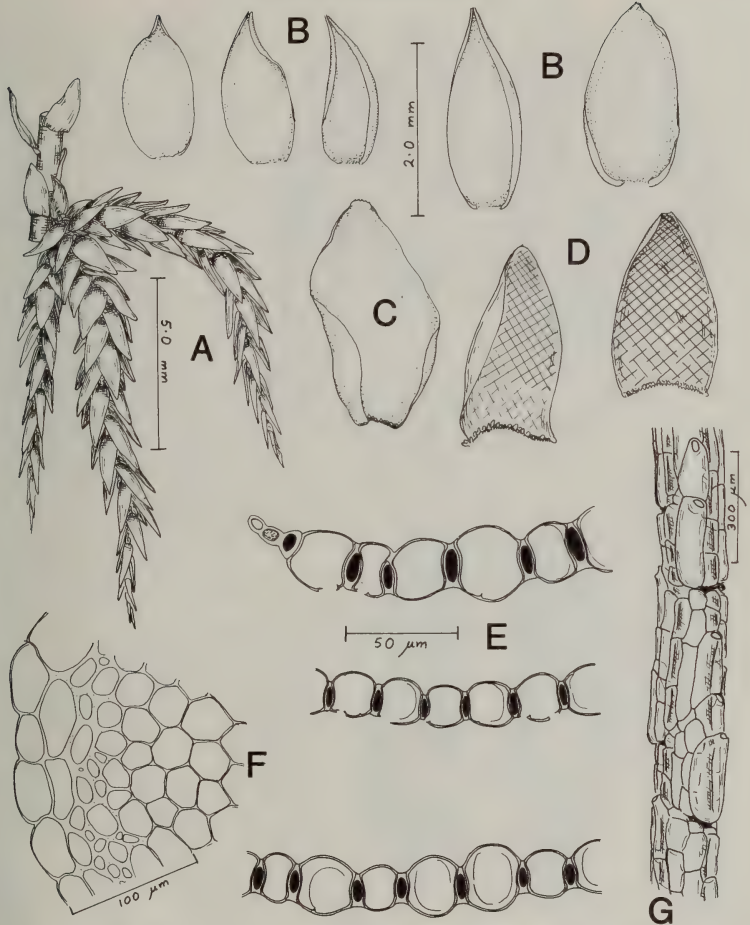

Fig. 16 *Sphagnum rutenbergii* C. Müll. A, branch fascicle; B–C, branch leaves; D, stem leaves; E, transverse sections of branch leaves; F, transverse section of stem; G, branch cortex (C drawn from a submerged plant; the remainder from the type collection).

(2–)4–5 branches which are not, or slightly dimorphic. Branches rather tumid or elongated and tapering, arched or somewhat laterally curved and cornute, with 40–60 or more fully developed leaves on stronger branches, 12·0–25·0 mm long. *Stems* rather strong, 0·7–1·0 mm diameter; cortex well developed, composed of (1–)2–3 layers of thin-walled hyaline cells, the outer series

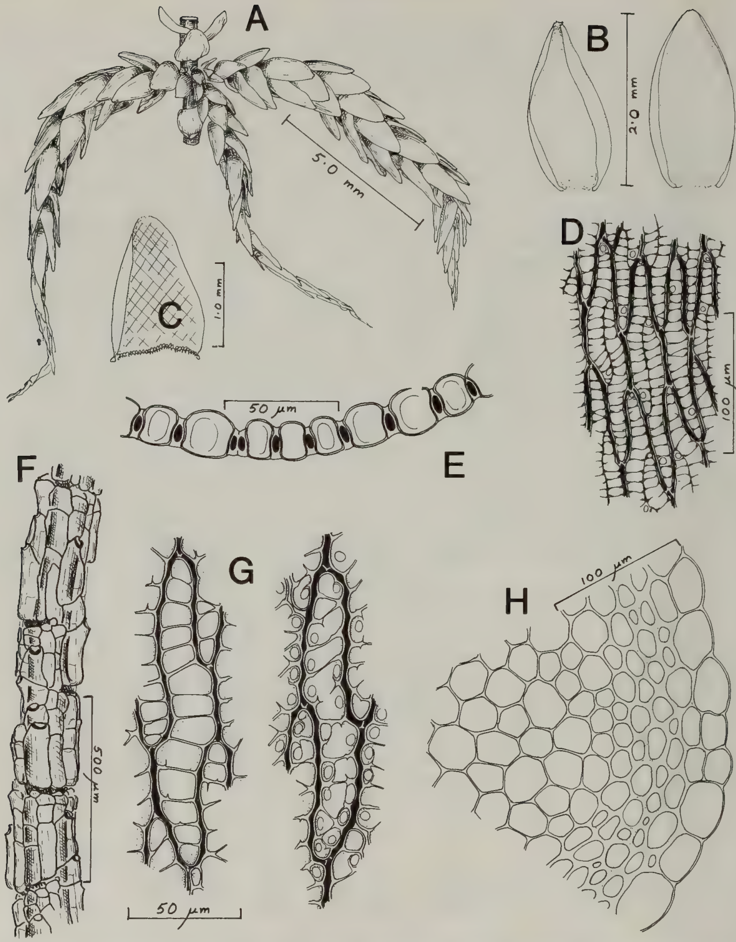

Fig. 17 *Sphagnum rutenbergii* C. Müll. A, branch fascicle; B, branch leaves; C, stem leaf; D, stem-leaf areolation; E, transverse section of leaf; F, branch cortex; G, adaxial (left) and abaxial (right) surfaces of branch leaf; H, transverse section of stem (all drawn from the type collection of *S. obovatum*).

frequently with faint pores or thinnings; internal cylinder rather well developed, pale except for a narrow band adjacent to the hyaloderm which is usually a rich red-brown. *Branch cortex* weakly to moderately dimorphic, retort cells in linear groups of 2–4, sometimes not differentiated in the lower parts of branches. *Stem leaves* ovate-lingulate to ovate-spathulate, large, 1·8–2·8 mm long, 0·8–1·2 mm wide; apex concave, more or less cucullate; border narrow, 2–4

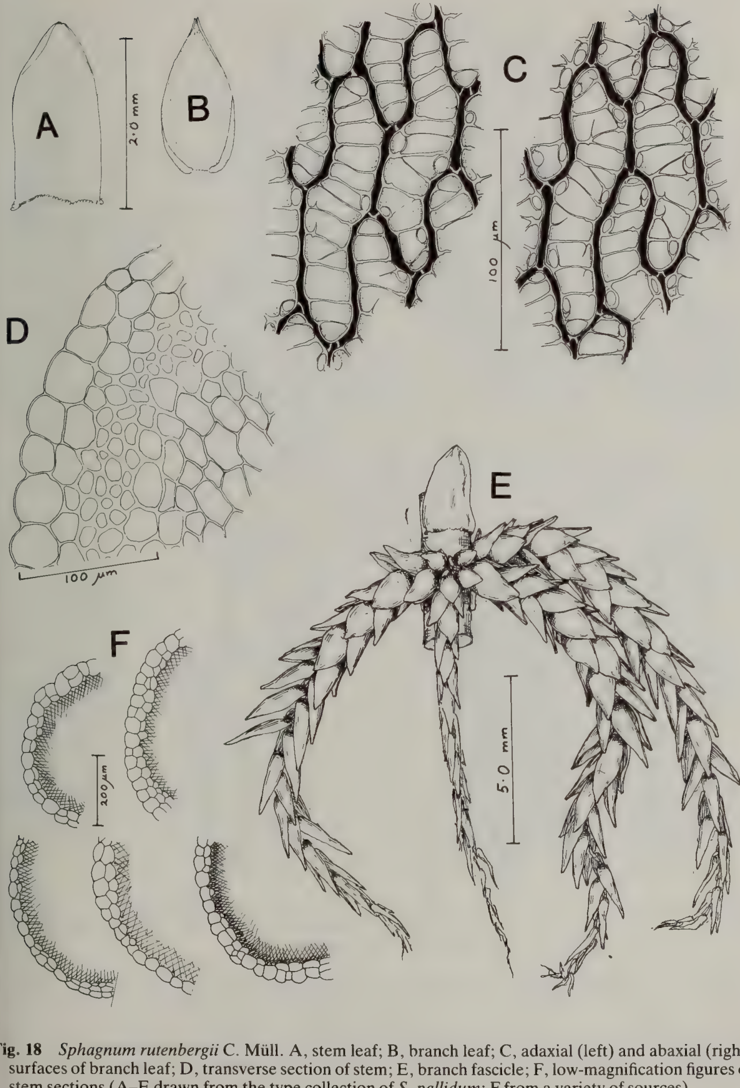

Fig. 18 *Sphagnum rutenbergii* C. Müll. A, stem leaf; B, branch leaf; C, adaxial (left) and abaxial (right) surfaces of branch leaf; D, transverse section of stem; E, branch fascicle; F, low-magnification figures of stem sections (A–E drawn from the type collection of *S. pallidum*; F from a variety of sources).

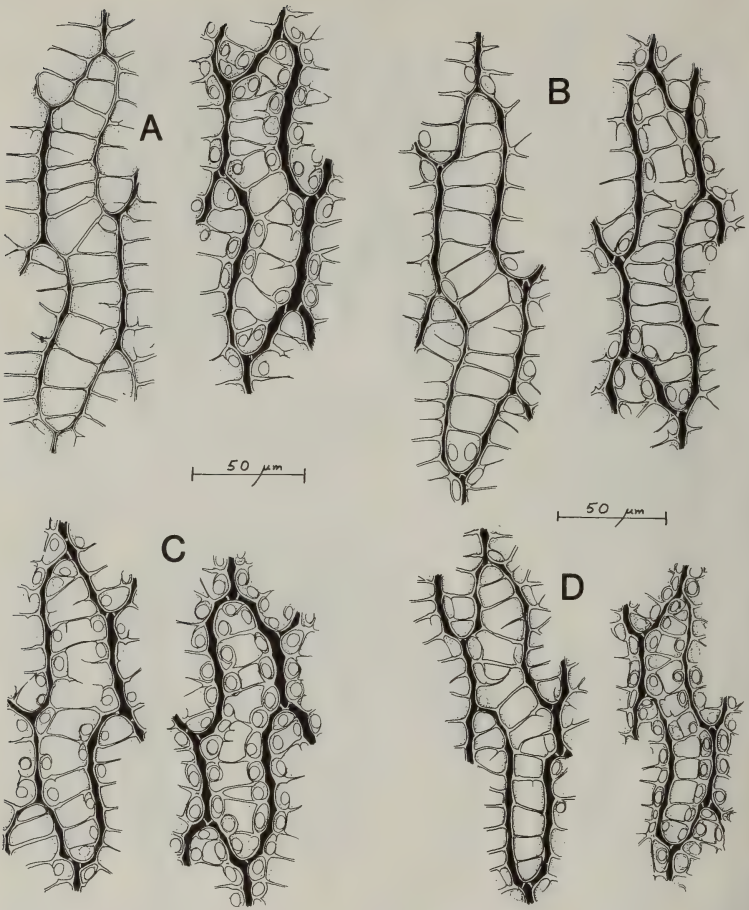

Fig. 19 *Sphagnum rutenbergii* C. Müll. A–D, adaxial (left figures) and abaxial (right figures) surfaces of branch leaves (A drawn from *Bosser* 8275; B from *Onraedt* 71.R.1039; C from the type collection of *S. aequifolium*; and D from the type collection of *S. salvanii*).

cells wide, not expanded below; tissues fibrillose throughout and more or less identical above to branch-leaf tissues. *Branch leaves* medium-sized to large, incumbent, basically 5-ranked, ovate, (1·4–)1·6–2·0(–2·8) mm long, 0·9–1·2 mm wide; apices truncate and 6–9-dentate, relatively narrow in proportion to the leaf dimensions; border narrow, 2 cells wide, without a resorption furrow. *Leucocysts* rather wide, 20–30 µm × 110–170 µm in mid leaf. Abaxial surface with numerous to abundant small, ringed pores *c.* 3·0–5·0 µm diameter scattered or in series along the

commisures, occasionally with 1–4 additional pores near the cell midline. Adaxial surface without pores or with a few scattered pores mainly in, or near, the apical and upper-lateral cell angles. *T.S. leaf.* Leucocysts more or less equally convex on both sides. Chlorocysts very narrow, mainly under 5·0 μm, narrowly oval-rectangular with oval lumina and incrassate abaxial and adaxial walls, more or less median and symmetrical with narrow (*c.* 2·0 μm) exposure on both sides of leaf. *Dioecious* ? No male plants seen. Female plants seen but only in an unfertilized condition.

Distribution. Growing in pure or mixed low mats or hummocks in marshy ground between 1500 and 2500 m alt. Endemic to the East African islands.

East African Islands. MADAGASCAR: Imerina, *Hildebrandt* 2106p.p. (BM, PC – neotype collections, in mixture with *S. tumidulum* and *S. planifolium*); same region, *Hildebrandt* s.n. (BM, PC – type collections of *S. aequifolium*); Amboritro, Amkatokapaitra, 1300–1400 m alt., *Salvan* s.n. (PC – type collections of *S. salvanii*); '. . . ohne näheren Standort . . .' (BM, herb. Mitten – type collection of *S. obovatum*); Massif d'Andringitra, 1600–2500 m alt., *P. de la Bathie* 44 (PC); Tampoketsa, 1600 m alt., *Humbert* s.n. (BM); Massif Andohahelo, *Humbert* s.n. (BM, PC); Ambositra, Mt. Antety, 1400–1850 m alt., *Humbert & Swingle* s.n. (BM); Ambatotoana, 1400 m alt., *Bosser* 9901, 15888 (BM, PC); Ambatolaona, *Benoist* 328 (PC); Ankafana, *Cowan* 23 (BM); Tananarive, Lake Manasoa, 1400 m alt., *Onraedt* 74.M.2105 (NAM); Ombadirafia, *Guillaumet* 2202 (BM, NAM). MAURITIUS: *Dr Ayres* s.n. (BM – type collection of *S. mauritianum*). RÉUNION: *Rodriguez* 10 (PC – type collection of *S. pallidum*); Plaine des Chicots, *De Poli* 23 (PC); Salazie, *Rodriguez* s.n. (PC); Maryakandriana, edge of swamp, 1300 m alt., *Bosser* 8275 (BM); Plaine des Palmistes, *Onraedt* 73.R.8089, 73.R.8195 (BM, NAM); Plaine des Cafres, 1584 m alt., *Onraedt* 69.R.0702 (BM); Cirque de Mafate, 1600 m alt., *Onraedt* 71.R.1039 (NAM, BM); *Chauvet* s.n. (PC).

The secondary pigments present are never intense. This feature, combined with the exceptionally narrow chlorocysts, gives the plant a rather 'washed out' appearance. Well developed specimens have long branches carrying many more leaves than the branches of *S. truncatum sens. lat.*, which *S. rutenbergii* otherwise resembles. Weaker, presumably semi-aquatic phases of *S. rutenbergii*, however, may be virtually superficially indistinguishable from pale states of *S. truncatum*. The safest character for separation rests on the stem section. The cortex is rather irregular in development but clearly 2–3 layered for the most part, and never more than 40 per cent 1-layered.

S. mauritianum was described by Warnstorf in the same work in which he described *S. pallidum*, basing the former on a specimen in Mitten's herbarium which had been collected by Dr Ayres in Mauritius. When he reduced *S. mauritianum* to a variety of *S. oxycladum* Warnst. (= *S. truncatum* Hornsch. var. *bordasii*), Warnstorf did so with reference to a quite different plant that had been collected in Madagascar by Besson. The latter collection is possibly conspecific with *S. truncatum*, but the plant from Mauritius is without doubt the same as *S. pallidum* (= *S. rutenbergii*).

Although Müller's original specimen was destroyed, and no duplicates can be traced, there is little uncertainty about the species he described. The selected neotype collection, represented in BM, PC and possibly other herbaria, is part of a mixed gathering examined by Müller and comprising three species: *S. madegassum* C. Müll. (= *S. planifolium*), *S. hildebrandtii* C. Müll. (= *S. tumidulum*), and a plant which he recognized as his *S. rutenbergii*. The last named is clearly the same taxon as the later described *S. pallidum* and *S. mauritianum* of Warnstorf.

9. **Sphagnum africanum** Welw. & Duby
(Figs 20 & 21)

in Duby in *Mém. Soc. Phys. Hist. nat. Genève* **21**: 216, tab. 1 fig. 1 (1870). Type: 'Ad rivulorum latera in summis provinciae Huilla regni Angolensis ad 5300–5500 pedes alt.', *Welwitsch* (BM).

S. angolense Warnst. in *Bull. Herb. Boissier* II, **1**: 1086 (1901).

Medium-sized, rather lax plants varying from dull green tinged with brown to more or less completely orange-brown. *Fascicles* commonly composed of only 1–2, never more than three branches. Branches tumid not contorted, up to 13·0 mm long but usually shorter than 10·0 mm,

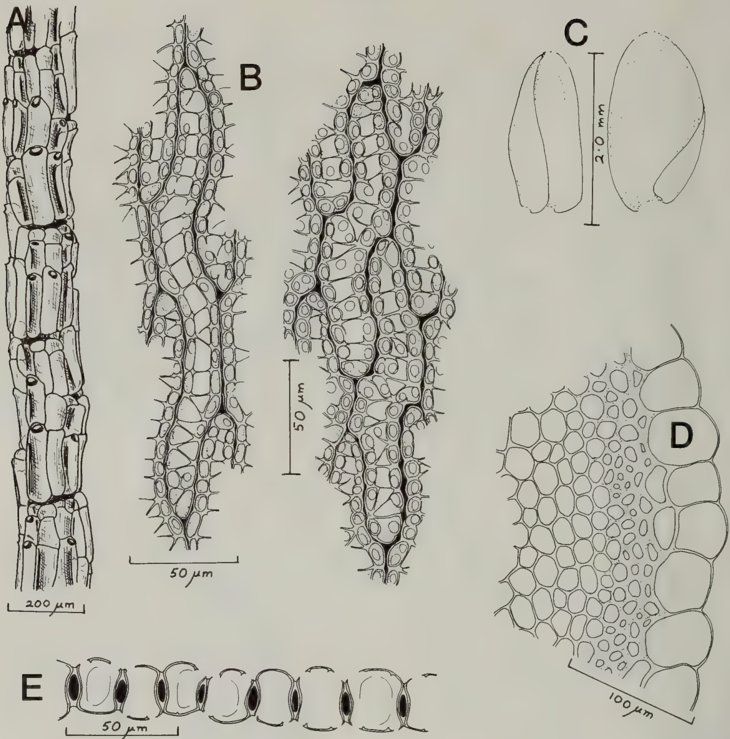

Fig. 20 *Sphagnum africanum* Welw. & Duby. A, branch cortex; B, adaxial (left) and abaxial (right) surfaces of branch leaf; C, branch leaves; D, transverse section of stem; E, transverse section of leaf (all drawn from the type).

not at all dimorphic. *Stems* generally rather weak, 0·3–0·6 mm diameter. Cortex mainly 1-layered but with a marked tendency towards local duplication and up to 50 per cent 2-layered, exposed cell walls without pores. Internal cylinder varying from pale yellow-brown to deep red-brown. *Branch cortex* with only slight differentiation of retort cells, most of the ordinary cortical cells having an apical pore. *Stem leaves* large to very large, 1·9–2·8 mm long, 1·2–1·3 mm wide, *always larger than branch leaves*, ovate to ovate-lingulate, widest at some distance (*c.* 1/4 to 1/3) above insertion, fibrillose throughout and virtually identical to branch leaves in structure. Border narrow, not widened below; apex concave and eroded. *Branch leaves* (1·2–)1·4–1·9(–2·1) mm, widely ovate, concave, symmetrical, erect. Border narrow, without a resorption furrow. *Apex broadly rounded, eroded, sub-cucullate*, never truncate-dentate. *Leucocysts* relatively wide (except in poorly developed plants), about 18–30 × 110–130 µm in upper mid-leaf. Abaxial surface with abundant small, ringed pores (occasionally partly replaced by pseudopores) in series along the commissures, sometimes with additional pores (ringed or unringed) in the cell midline; pores (i.e. apertures) 2·0–4·0 µm diameter on average. Adaxial

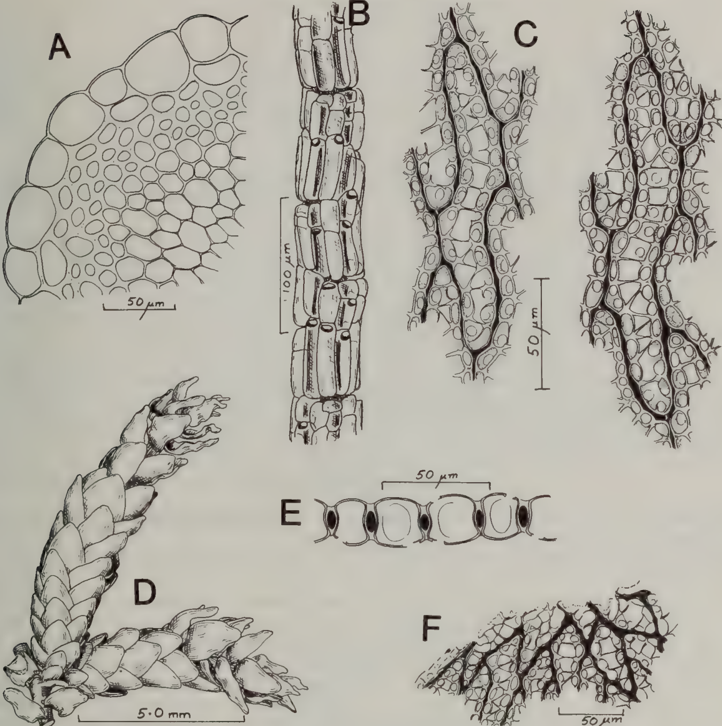

Fig. 21 *Sphagnum africanum* Welw. & Duby. A, transverse section of stem; B, branch cortex; C, adaxial (left) and abaxial (right) surfaces of branch leaf; D, branch fascicle; E, transverse section of leaf; F, branch-leaf apex (D drawn from the type collection; the remainder from *Townsend* 75/261).

surface variable, generally with a few scattered small pores but few to numerous pseudopores, especially in the upper half of the leaf. *T.S. leaf.* Leucocysts biconvex, usually more inflated on the abaxial side. Chlorocysts variable; in weak specimens more or less oval-rectangular and exposed subequally on both sides of leaf, *typically distinctly displaced towards the adaxial face*, with very narrow abaxial exposure and here and there appearing immersed. Fertile material not seen.

Distribution. Scattered occurrences in montane regions in a zone across southern-central Africa from Huila Province (Angola) to Malawi.

West Africa. ANGOLA: Huila, *Welwitsch, Iter Angolense* 11 (BM, L, PC – type collections); Lubango, *Borges* 249 (BM).

Mlanje/Chimanimani. MALAWI: Mlungasi Falls, 1700 m alt., *Hornby* 6 (BM). ZAMBIA: Shiwa Ngandu, 'moorland drainage in peat bog, common', 1500 m alt., *Greenway* 5501 (BM, PRE); Mwinilunga, 1350 m alt., *Townsend* 75/193 (BM). ZIMBABWE: Mt. Nuza, 'damp hollows between grass clumps', 1700 m alt., *Gilliland* 509B (BM).

Ruwenzori/Usambara. ZAIRE: Katanga, *Overlaedt, Bryotheca R. Naveau* B2, B3, B4 (H); Shaba Province, 1700 m alt., *Townsend* 75/261, 75/267 (BM).

The small, serially disposed pores and basically single-layered stem cortex of this taxon suggest a relationship with *S. truncatum*. However, there is little risk of confusion between the two species, the morphology of the leaf apices being quite different and sufficiently stable to facilitate discrimination between them. Smaller examples of *S. africanum* can superficially resemble species of the *S. capense* group in colour and external features, but lack the highly developed cortex and branch-retort cells of the latter group.

Warnstorf had not seen Welwitsch's gathering when he described *S. angolense*, and seems to have been influenced by Duby's misguiding allusion to similarities between *S. africanum* and *S. pylaesii*.

Those plants with comparatively small (*c.* 1·6–1·8 mm) branch leaves and distinctly adaxially biased chlorocysts should be considered to represent the normal expression of the species. Specimens with more or less symmetrically disposed chlorocysts with subequal adaxial and abaxial exposure may be expressions of the species in response to immersion or shading. In such widely dispersed populations, however, a degree of infraspecific, genetically based variation is to be expected in this, as in many other African taxa.

A broader interpretation of *S. africanum* is given by Magill (1981). A number of names are drawn into synonymy with this species which, in the present work, are considered to be aligned more appropriately with *S. truncatum*. Thus *S. rehmannii* Warnst., *S. transvaaliense* C. Müll., *S. oligodon*, var. *bachmanii* Warnst., and *S. oligodon* var. *beyrichii* Warnst. are transferred from synonymy with *S. africanum* to that of *S. truncatum* Hornsch. *sens. lat.*

Subsection *ACROSPHAGNUM*

Sphagnum sect. ***Subsecunda*** subsect. ***Acrosphagnum*** (C. Müll.) A. Eddy, **stat. nov.** – *Sphagnum* 6: *Acrosphagnum* C. Müll. in *Flora, Jena* **70**: 405 (1887).

Sphagnum [sect.] *Mucronata* Warnst. in *Hedwigia* **30**: 127 (1891). Lectotype: *S. mucronatum* C. Müll. = *S. tumidulum* Bescher.

Plants small to medium-sized, lax or dense, yellow-green to brownish, sometimes with dull purple or red undertones. Stems typically brownish; hyaloderm very well developed, of 2–3 layers of thin-walled leucocysts, the outer much larger than the inner and usually with an unringed large pore in the outer wall. Branch cortical cells usually markedly dimorphic, retort cells in linear groups of 2–3, usually strongly protuberant at apex. Branch leaves usually very regular in size, all except a few basal ones ovate, concave, distinctly 5-ranked, abruptly narrowed to mucronate, pseudomucronate or eroded apices. Stem leaves very variable but typically as large as or larger than branch leaves; fibrillose in the apical region, commonly throughout, seldom efibrose.

Branch-leaf leucocysts normally relatively short and wide, 25·0–35·0 × 70·0–100 μm long, pores variable in size and distribution. Chlorocysts with rounded lumina in cross section, variable in disposition relative to the leaf surfaces.

This group is principally African, with one species occurring also in Sri Lanka. It grades into subsection *Subsecunda*, and some non-African taxa could be construed as intermediate between the two groups (e.g. *S. ovatum* Hampe of N.E. India, Thailand, and Taiwan; *S. gracilescens* Hampe ex C. Müll. of tropical South America). There are no obvious intermediates in the African flora, although *S. africanum*, in its small-leaved expressions, exhibits features that could point to a common origin (see pp. 113–116).

This subsection contains plants that are rather uniform in external appearance but exhibit a wide diversity in the morphology of their branch-leaf cells. The type species, *S. tumidulum* Bescher., is the most divergent, and were it not for the existence of a number of connecting forms (i.e. *S. pycnocladulum* var. *ericetorum, S. tumidulum* var. *confusum* and *S. tumidulum* var. *tumidulum*) might well be placed in a section of its own. The small, wide, uniform and numerous branch leaves, often markedly 5-ranked, give rise to plants with a characteristically neat appearance, reminiscent of the boreal *S. tenellum* (Brid.) Brid. The hyaloderm of the stem,

coupled with the large stem leaves, are distinctive features, while branch-leaf areolation can approach that of section *Acutifolia* with regard to width and pore size. However, the latter features can vary widely, even in a single gathering, and repressed forms (e.g. from unfavourable habitats) and less evolved species (e.g. *S. davidii*) can have narrow, small-pored leucocysts that are virtually identical to those of subsection *Subsecunda*. Variability in chlorocyst position, which is an unusual feature within a section, led to widely differing systematic interpretations by other authors. This has been discussed at length elsewhere (Eddy, 1979).

Within the subsection, *S. davidii* is the African species which shows least divergence from subsection *Subsecunda*, while the existence of the extreme form, *S. tumidulum*, suggests that it is a taxon of considerable age. This view can be reinforced if the morphological features of *S. ceylonicum* (p. 135) are accepted to indicate common ancestry with section *Acutifolia*. *S. tumidulum* itself may have had a pre-mid-Cretaceous origin (see above, p. 79) but section *Acutifolia* is probably even older. If the suggested phylogenetic interpretation is valid, then subsect. *Acrosphagnum* must be a 'pre-Drift' taxon.

Where Müller (1887, *loc. cit.*) briefly described the infrageneric group '6. *Acrosphagnum*', he appended the term 'Sphagna mucronata'. Clearly the epithet '*mucronata*' was intended to be descriptive, not nomenclatural, indicating that the author considered *S. mucronatum* (= *S. tumidulum*) to be morphologically representative.

Warnstorf (1891, 1900, 1911) gave no explanation for his selection of the name '*Mucronata*', which he ascribed erroneously to Müller, in place of '*Acrosphagnum*'. Van der Wijk et al (1967) also seem to be in error where they indicate that Muller himself ('l.c.') reduced [sect.] *Acrosphagnum* to synonymy.

Since '*Acrosphagnum*' is validly described and unambiguously typified, I can find no good reason for its rejection in favour of Warnstorf's choice of name.

10. **Sphagnum tumidulum** Bescher.
(Figs 22 & 23)

in *Annls Sci. nat.* (Bot.) VI, **10**: 329 (1880). Lectotype: Réunion, *Richard* s.n. (PC).

10a. **Sphagnum tumidulum** var. **tumidulum**
(Fig. 22)

S. tumidulum var. *macrophyllum* Warnst. in *Hedwigia* **30**: 128 (1891).
S. tumidulum var. *microphyllum* Warnst. in *Hedwigia* **30**: 128 (1891).
S. aculeatum Warnst. in *Bot. Zbl.* **9**: 97 (1882).
S. hildebrandtii C. Müll. in *Flora, Jena* **70**: 420 (1887).
S. mucronatum C. Müll. in *Flora, Jena* **70**: 421 (1887).
S. imbricatum Schimper ex Warnst. in *Hedwigia* **30**: 128 (1891), *nom. syn.*
S. submucronatum C. Müll. ex Warnst., *Sphagnol. univ.*: 172 (1911), *nom. syn.*
S. pugionatum C. Müll. ex Warnst., *Sphagnol. univ.*: 172 (1911), *nom. syn.*

Plants small to medium-sized, compact or occasionally rather lax; light yellow-brown or yellowish-ochre, rarely green. *Fascicles* closely set, rarely somewhat distant, composed of (4–)5–6 monomorphic branches (if 6, then one branch usually very weak). Branches very uniform in structure and form but variable in length, (4·0–)6·0–15·0(–20·0) mm long, of uniform diameter, not tapering. *Stems* normally relatively strong, 0·6–1·0 mm diameter, pale to mid brown. Cortex well developed, basically 2-layered with an outer, highly inflated series of leucocysts much larger than the inner; most outer cortical cells with a large pore in the exposed wall. Internal cylinder well developed but individual cells not grossly thickened; walls of outer layers yellow-brown to deep brown. Median parenchyma yellowish or colourless, but sometimes with a group of cells in the middle having dark brown walls, resembling a false central strand. *Branch cortex* dimorphic: retort cells highly inflated, mainly in linear pairs, slightly to moderately protuberant at apertures. *Stem leaves* relatively large, 1·4–2·0 mm long, 0·7–0·8 mm wide, lingulate to triangular-lingulate, suddenly contracted above to mucronate tips. Border strong, 4–6 cells wide, not or very indistinctly widened below. Hyaline cells always fibrillose in the upper half of leaf but fibrils often incomplete, rarely fibrillose to insertion; fibrillose tissue more or less

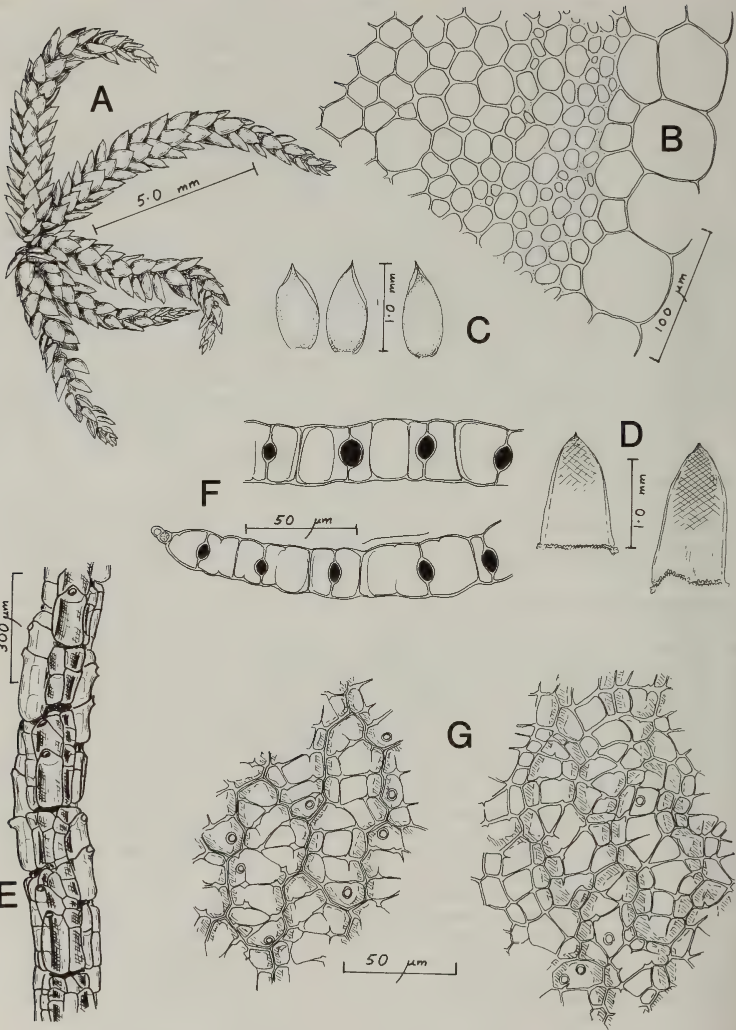

Fig. 22 *Sphagnum tumidulum* Bescher. var. *tumidulum*. A, branch fascicle; B, transverse section of stem; C, branch leaves; D, stem leaves; E, branch cortex; F, transverse sections of leaf; G, adaxial (left) and abaxial (right) surfaces of branch leaf (all drawn from *Richard* s.n.).

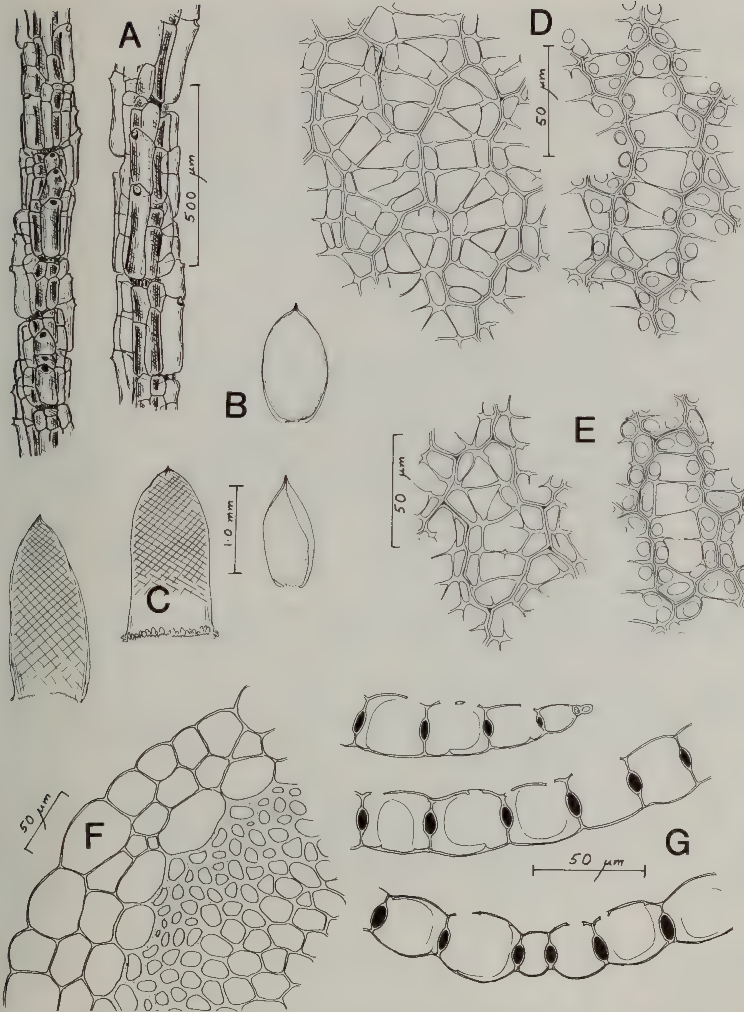

Fig. 23 *Sphagnum tumidulum* Bescher. var. *confusum* A. Eddy. A, branch cortex; B, branch leaves; C, stem leaves; D–E, adaxial (right) and abaxial (left) surfaces of branch leaves; F, transverse section of stem; G, transverse sections of leaves (C, right fig, and E drawn from *Bosser* 11369; the remainder from *Bory*).

identical to branch-leaf tissue. *Branch leaves* very uniform in size and direction, strictly 5-ranked in straight rows so that branches appear prismatic in form, small, 1·0–1·6 mm long, ovate, very concave; apices acute or more or less sharply mucronate with strongly inflexed or 'pinched in' margins, apical resorption absent or very weak; border 2–3 cells wide. *Leucocysts* short and relatively wide, 70–90 μm long, 25–35 μm wide; commissural walls of adjacent leucocysts fused throughout, the common walls generally thin. Abaxial surface with thin fibrils and scattered to serial pseudopores, with nodular thickenings at the anastomoses so that the cell surfaces appear reticulate rather than fibrillose; pores absent or few, minute, ringed, circular, remote from commissures, *c.* 2·0 μm diameter. Adaxial surface similar to abaxial surface but usually with less numerous pseudopores; pores 1–6 per cell, minute, ringed, remote from commissures, *c.* 2·0 μm diameter. *T.S. leaf.* Leucocysts almost plane on both sides, frequently with thin internal, longitudinal partitions in addition to the poorly developed transverse, partial septa. Chlorocysts thin-walled, broadly oval to almost circular, deeply immersed and remote from both leaf surfaces; internal commissural walls smooth.

Distribution. Endemic to the East African islands, in a variety of terrestrial habitats, mainly at altitudes above 1000 m.

East African Islands. MADAGASCAR: Imerina, *Hildebrandt* s.n. (BM, PC, mixed with *S. pallidum*, source material of *S. aequifolium* and *S. hildebrandtii*); between Vinanentelo and Ikongo, *Besson* s.n. (PC); Massif Tsaratanana, siliceous soil in humid forest, 2000 m alt., *Humbert* s.n. (PC); Massif d'Andringitra, bog hollows at 2000 m alt., *Humbert* 51, 52 (PC); Ankaratra, below Manjakatampo, 2200 m alt., at edge of stream, *Bosser* 15048 (PC); Ivohibe, siliceous rocks at 1500–2000 m alt., *Humbert* 60 (BM); Massif Beampingaratra, summit of Bekoho, 1500 m alt., *Humbert* s.n. (BM); Fianarantsoa, *Bosser* 17.801 (BM, NAM). MAURITIUS: 'Tourbière a Philippia', 600 m alt., *Onraedt* 71.Ma.237 (NAM). RÉUNION: *Lépervanche* (PC – lectotype of *S. tumidulum*); *Richard* (PC – isosyntype); *Rodriquez* s.n. (BM); *Bory de St. Vincent* s.n. (BM); Plaine des Cafres, 1550 m alt., *Onraedt* 69.R.103, 69.R.0473 (BM, NAM); Commune de St Philippe, bog at 1900 m alt., *Gimalac* s.n. (BM); Cirque de Cilaos, bog at 2300 m alt., *Gimalac* s.n. (BM); river valley north of the Fournaise, bog at 1800 m alt., *Gimalac* s.n. (BM, NAM, herb. Onraedt no. 71.R.6536), also from more or less the same region, several other specimens collected by *Gimalac*, in NAM and BM under Onraedt herbarium numbers, e.g. 71.R.8505, 71.R.8531; Plateau des Chicots, 1200 m alt., *Onraedt* 71.R.9252 (BM, NAM).

The typical, and by far the commonest form of *S. tumidulum*, is a plant that can be identified almost at a glance. The numerous, closely set, very uniform, mucronate and strictly 5-ranked, rather patent and concave branch leaves result in a facies that is highly characteristic and matched only by some robust states of a few other species of subsection *Acrosphagnum* which are rare or absent in the East African islands. The peculiar, reticulate appearance of the branch-leaf leucocysts may be encountered in some states of *S. pycnocladulum* but these differ in the numerous, usually serial, pores on the abaxial leaf surfaces. *S. ericetorum* has adaxially seriate pores, but exposed chlorocysts.

S. tumidulum has been recorded from time to time from mainland Africa. With one exception, all such records have been based on misidentifications (e.g. of *S. pycnocladulum* and its allies). The exception is a specimen purporting to originate from 'Côte orientale d'Afrique, recolté en 1913 par le P. Gattang sur les pentes du Mkomboko (2500 m) dans l'Ourongourou' [Uronguru ?]. The data are supplied at secondhand by R. P. Sacleuse, probably in error since Gattang appears to have made collections from both East Africa and the East African islands in the same year.

10b. Sphagnum tumidulum var. confusum A. Eddy, var. nov.
(Fig. 23)

S. tumidulo typico adspectu simillimum sed foliis caulinis longioribus et cellulis hyalinis ad eorum apices parce vel valde fibrosis. Cellulae hyalinae foliorum ramorum poris majoribus (4·0–6·0 μm) manifeste seriatis in paginis ventralibus instructae.

(Typus: Réunion, Plaine de Palmista, *Bory*, growing in a mat of a pale form of *S. violascens* C. Müll. (BM, herb. Schimper – holotypus.)

Plants closely resembling the typical variety but stem leaves rather more elongated and distinctly to extensively fibrillose in the sub-apical region. Hyaline cells of branch leaves furnished with numerous, clearly seriate, rather large (4·0–6·0 μm), ringed pores along the commissures on the adaxial side.

Distribution of the typical form, but very infrequent or overlooked.

East African Islands. RÉUNION: Plaine de Palmista, *Bory* (BM – holotype); Brûléde St. Denis, 1100 m alt., *Bosser* 11369 (PC).

There is a tendency in section *Subsecunda* for normally dorsiporose species-complexes to produce ventriporose variants. Sometimes these are inconsequential from a taxonomic viewpoint, being clinally interconnected with 'normal' plants. At other times, intermediate states are rare or unknown and it is then convenient to recognize them by name, usually at an infraspecific level. In *S. tumidulum* var. *confusum*, the mere presence of '*Acrosphagnum*'-type pores is a character sufficient to separate the taxon from *S. tumidulum* var. *tumidulum*. At the same time, the nature of the pores demonstrates the positive link between *S. tumidulum* and the '*S. capense* group' in subsection *Acrosphagnum*, while their distribution strongly suggests phylogenetic proximity to *S. ericetorum*. It is possible, in fact, to arrange species in a kind of stepped cline, thus: *S. davidii*–*S. pycnocladulum*–*S. ericetorum*–*S. tumidulum* var. *confusum*–*S. tumidulum* var. *tumidulum*, suggesting a monophyletic sequence of evolutionary events.

The variety could very easily be confused with *S. ericetorum* since, even under the microscope, the superficial resemblance of their branch leaves is striking. However, the stem leaves of *S. tumidulum* var. *confusum* maintain the basically triangular form of the type variety, with involute, more or less mucronate apices and strong, distinctly expanded borders. In *S. ericetorum*, the chlorocysts are narrowly exposed on the abaxial side, not immersed as in the present taxon.

11. Sphagnum davidii Warnst.
(Figs 24 & 25)

in *Allg. bot. Z.* **11**: 99 (1905). Type: East Africa: 'Hochmoore in 2240 m. Meereshöhe auf dem Berge Runsoro 1904 von Dr. J. David gesammelt.' (BM – isotype). – *S. davidii* var. *brachydasycladum* Warnst. in Mildbr. in *Wiss. Ergebn. dt. ZentAfr. Exped.* **2**: 135 (1910). – *S. davidii* var. *viride* Warnst., *Sphagnol. univ.*: 383 (1911). – *S. davidii* var. *flavo-fuscescens* Warnst., *Sphagnol. univ.*: 383 (1911).
S. chevalieri Warnst., *Sphagnol. univ.*: 311 (1911).
S. afro-crassicladum Dixon & Sherrin in Dixon in *J. Bot., Lond.* **76**: 218 (1938).

Plants variable in stature, typically medium-sized to rather robust, rarely as small and delicate as *S. capense*, green tinged with orange varying to rich orange-brown. *Fascicles* usually rather closely set, composed of at least 5, frequently 6–7 branches; branches varying in vigour and attitude but not dimorphic, the strongest up to 22·0 mm long but often much shorter. *Stems* 0·6–1·0 mm diameter; cortex well developed, of 2(–3) layers of thin-walled leucocysts, the outermost largest and commonly with a large pore in the exposed wall. Internal cylinder strong, yellow-brown to dark red-brown. *Branch cortex* dimorphic: retort cells distinct, mainly in linear pairs; neighbouring cortical cells also sometimes perforate. *Stem leaves* large, lingulate to more or less spathulate, 1·6–2·6 mm long, 0·9–1·3 mm wide; fibrillose in the upper half or almost to insertion, fibrillose portions anatomically similar to branch-leaf tissues; border narrow, 2–4 cells wide, not expanded below; apex eroded, rounded-obtuse, concave. *Branch leaves* 5-ranked, mainly ovate but some basal leaves on strongest branches may be longer and narrower and tend to be slightly homomallous and asymmetric; border narrow, 1(–2) cells wide, sometimes partially resorbed in the upper half; apex narrowly truncate-dentate, sometimes appearing subacute with tightly inrolled upper margins. *Leucocysts* rather variable; in narrower leaves (when present) leucocysts narrow, 18·0–20·0 × 90–150 μm, in normal leaves shorter and wider, 20·0–30·0 × 80–130 μm in upper mid-leaf. Abaxial surface with small, ringed pores, 4·0–6·0 μm diameter, in series along the commissures; with or without 1–6 additional pores near the cell mid-line. Adaxial surface variable; typically without or with few pores and/or pseudopores but occasionally multiporose. *T.S. leaf.* Chlorocysts narrow with oval to narrowly oval rectangular lumina,

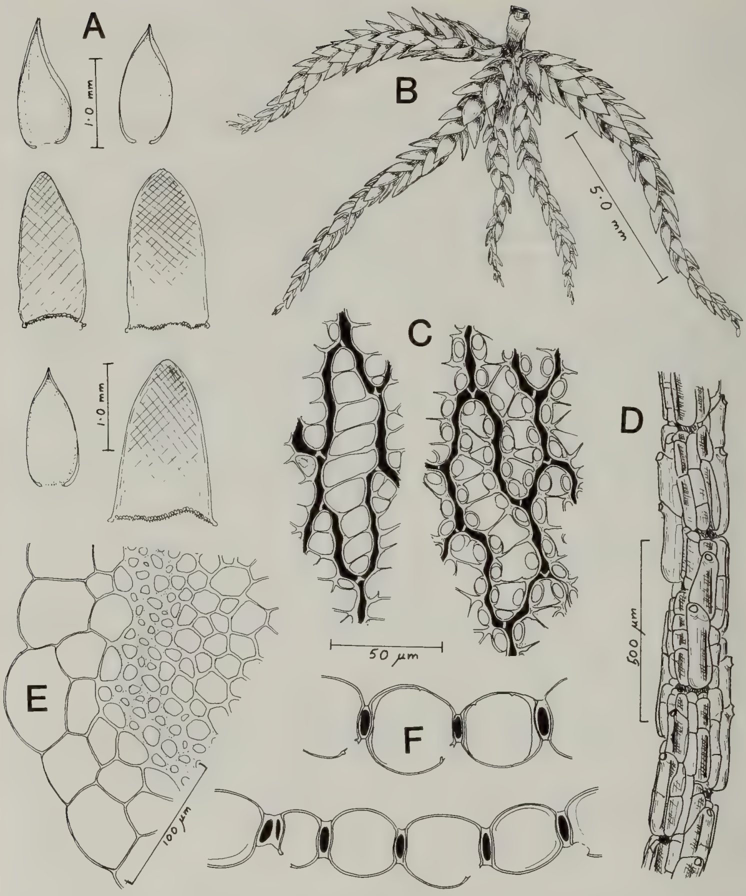

Fig. 24 *Sphagnum davidii* Warnst. A, branch leaves (above and lower left) and stem leaves; B, branch fascicle; C, adaxial (left) and abaxial (right) surfaces of branch leaf; D, branch cortex; E, transverse section of stem; F, transverse sections of branch leaf (all drawn from the type collection).

more or less median and narrowly and more or less equally exposed on both sides of leaf; abaxial and adaxial walls usually strongly thickened. *Dioecious*. Male plants not seen. Female plants relatively frequent, but no fertilized material available for study.

Distribution. Apparently a rare and local but widespread species. Its main occurrence is in the high mountains of Ruwenzori and Runsoro, extending southwards to Mlanje, and in the East African islands. Also scattered in West Africa.

West Africa. SIERRA LEONE: Tingi Hills, *c.* 1500 m alt., *Morton* s.n. (BM). IVORY COAST:

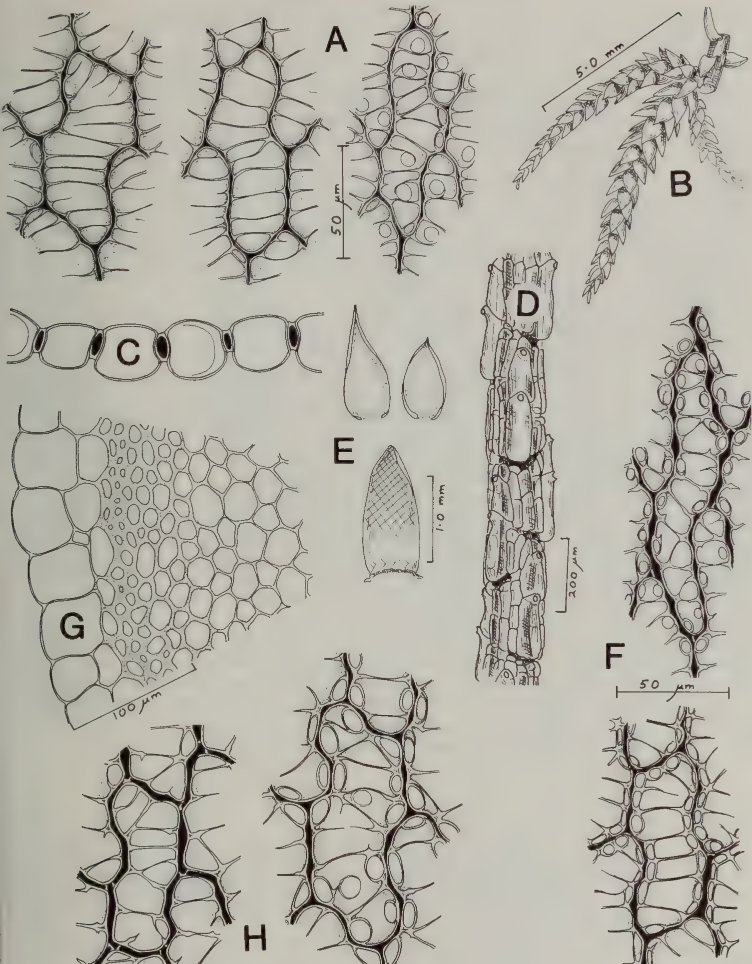

Fig. 25 *Sphagnum davidii* Warnst. A, abaxial (left) and adaxial surface of branch leaf (*S. chevalieri* form); B, branch fascicle; C, transverse section of leaf; D, branch cortex; E, branch leaves (above) and stem leaf (below); F, adaxial (above) and abaxial (below) surfaces of branch leaf; G, transverse section of stem; H, adaxial (left) and abaxial (right) surfaces of branch leaf (A–E drawn from the type of *S. chevalieri*; F from *Morton* s.n.; and H from *Lupton* 217).

Guineko, *Chevalier* 5 (PC – type collection of *S. chevalieri*). NIGERIA: Gongola State, Gangirwal, *c.* 7500 ft [2290 m] alt., *Chapman* 3431 (BM, FHO). CAMEROON: Babadjou Santa, *Jacques-Felix* 2811 (PC).

Mlanje/Chimanimani. MALAWI: Mlanje Mountains, 6000 ft [1750 m] alt., *Lupton* 217, 218 (BM).

Ruwenzori/Usambara. ZAIRE: Runsoro, 'Hochmoore in 2400 m . . .' *David* s.n. (BM – isotype of *S. davidii*); Ruwenzori, Buamba, 3400–3800 m alt., *Alluaud* 291, 292 (PC; 291 is the type collection of *S. davidii* var. *flavo-fuscescens*); *Eggeling* 1341 (BM); Kivu, various localities between 2500 and 3500 m alt., *Humbert* 7844, 7853, 7858, 7859 (BM, PC); Kivu, *Hendricks* 3350, 3709 (PRE); Kivu, piste du Kahuzi, 2750 m alt., *De Sloover* 12697, 12776, 12954 (BM, NAM); Rungwe Mt., *Leedal* 4352 (BM). RWANDA: Rugege, 2020 m alt., wet rocks with *Breutelia, De Sloover* 12539 (BM, NAM); Birunga, Karisimbi crater, 3900 m alt., *De Sloover* 13218, 13264 (BM, NAM). UGANDA: Manwamba Valley, 2800 m alt., *Taylor* 2886 (BM); Toro District, in heath forest at 4200 m alt., *Osmaston* 3892 (BM); Ruwenzori, Bigo, 3500 m alt., *Osmaston* 3719 (BM); Ruwenzori, in 'ericetum' by stream, 3800 m alt., *Haeman* 841 (BM). KENYA: Aberdare Mountains, summit of Kinangop, 3750 m alt., *Galpin* 7926; (PRE); Aberdare Mountains, Kinangop, *Balbo* 184 (BM); *Taylor* 1615 (BM – type collection of *S. afro-crassicladum*). TANZANIA: Morogoro, Kitundu, 1500 m alt., *Bruce* M.13 (BM).

East African Islands. RÉUNION: Piton des Neiges, 2300 m alt., *Gimalac* 70.R.5005 (BM, NAM; a rather ambiguous plant showing some approach to *S. ceylonicum* in structure); 'Cirque de Cilaos, Sentier du Piton des Neiges', 2000 m alt., *De Sloover* 17.874 (BM, NAM).

It will be clear from the description that *S. davidii* is closely related to *S. pycnocladulum* on the one hand and to *S. ceylonicum* (see below) on the other. Comparatively few specimens have been collected, but some of these are from widely dispersed localities, and they demonstrate a fairly wide range of variation in habit and porosity. The median, more or less symmetrically disposed, chlorocysts, which invariably reach both leaf surfaces, offer the safest character by which *S. davidii* is distinguished from the other species mentioned.

The plant described under the name *S. chevalieri* is a variant with markedly ventriporose branch leaves. In the other West African collections cited above this feature is much less in evidence, and these plants are matched by similar forms from East Africa. In the southern part of its East African range plants tend to be smaller, without the narrower basal branch leaves, and are superficially similar to *S. capense*.

Some allusion has been made elsewhere (Eddy, 1979) concerning the systematic position of *S. davidii*. To reiterate in brief, the narrower basal branch leaves (when present), strongly isoareolate stem leaves, and median chlorocysts indicate a relatively 'primitive' condition within subsection *Acrosphagnum*. This is supported to a degree by its wide distribution since it is the only trans-African species of the subsection. Evolutionary divergence is suggested towards *S. ceylonicum* (thence to section *Acutifolia*?) on the one hand, with adaxially displaced chlorocysts, and towards *S. pycnocladulum* and *S. capense* (and, ultimately, to *S. tumidulum*) on the other, with abaxially displaced or enclosed chlorocysts.

12. **Sphagnum capense** Hornsch.

(Figs 26–29)

in *Linnaea* **15**: 113 (1841). Lectotype: 'In der Kluft nach dem Gipfel des Tafelberges', *Ecklon* (BM, PC). Paratypes: 'Dutoitskloof am Wasserfalle 1600 f. . . .' *Drège* (BM, PC); 'An einer kleiner Quelle . . .', *Ecklon* (H). – *S. capense* var. *multiporosum* Warnst., *Sphagnol. univ.*: 428 (1911). – *S. capense* var. *mollissimum* (C. Müll.) Warnst., *Sphagnol. univ.*: 428 (1911). – *S. capense* var. *austro-molle* (C. Müll.) Warnst., *Sphagnol. univ.*: 428 (1911).

S. mollissimum C. Müll. in *Flora, Jena* **70**: 418 (1887). – *S. mollissimum* var. *elongatum* Rehmann in Warnst., *Sphagnol. univ.*: 428 (1911), *nom. syn.*

S. panduraefolium C. Müll. in *Flora, Jena* **70**: 418 (1887).

S. austro-molle C. Müll. in *Flora, Jena* **70**: 419 (1887).

S. islei Warnst. in *Hedwigia* **30**: 14, 19, tab. 1 fig. 6, tab. 4 fig. f (1891).

S. subrotundifolium C. Müll., *Gen. musc. frond.*: 102 (1900), *nom. nud.*

S. wenckei Röll in *Öst. bot. Z.* **57**: 7 (1907).

S. pappeani Breutel in Warnst., *Sphagnol. univ.*: 427 (1911), *nom. syn.*

S. humbertii Cardot in *Bull. Mus. natn. Hist. nat. Paris* **22**: 342 (1916).

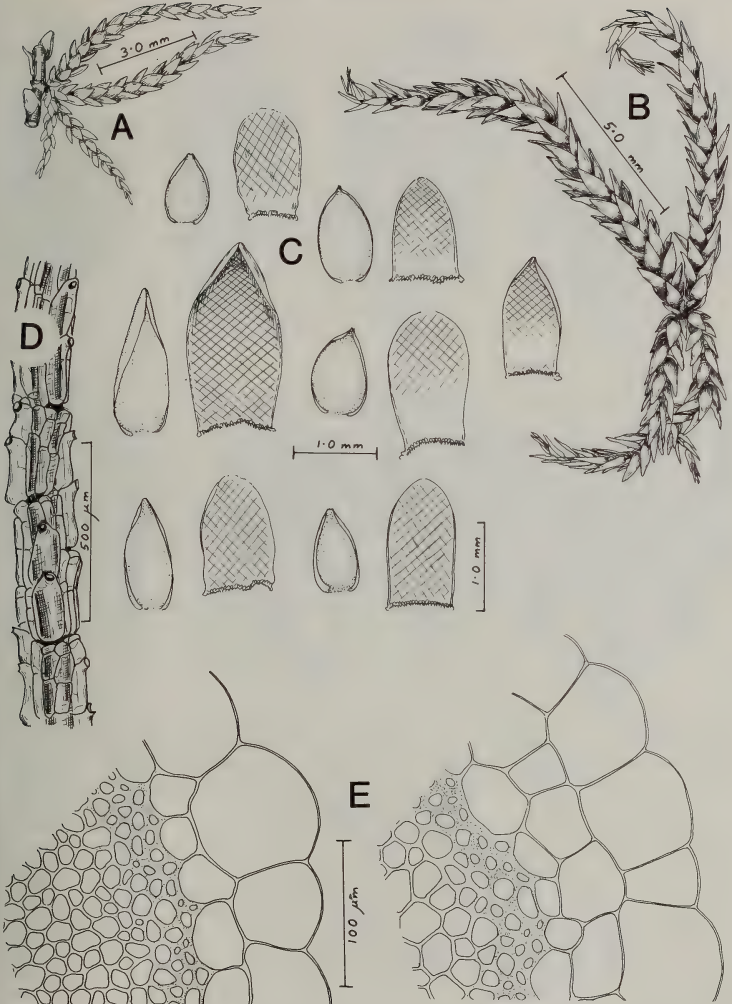

Fig. 26 *Sphagnum capense* Hornsch. A, B, branch fascicles; C, branch leaves (left figs) and stem leaves (right, cross-hatched figs); D, branch cortex; E, transverse sections of stems (B drawn from Ecklon's type collection; the remainder from various South African localities).

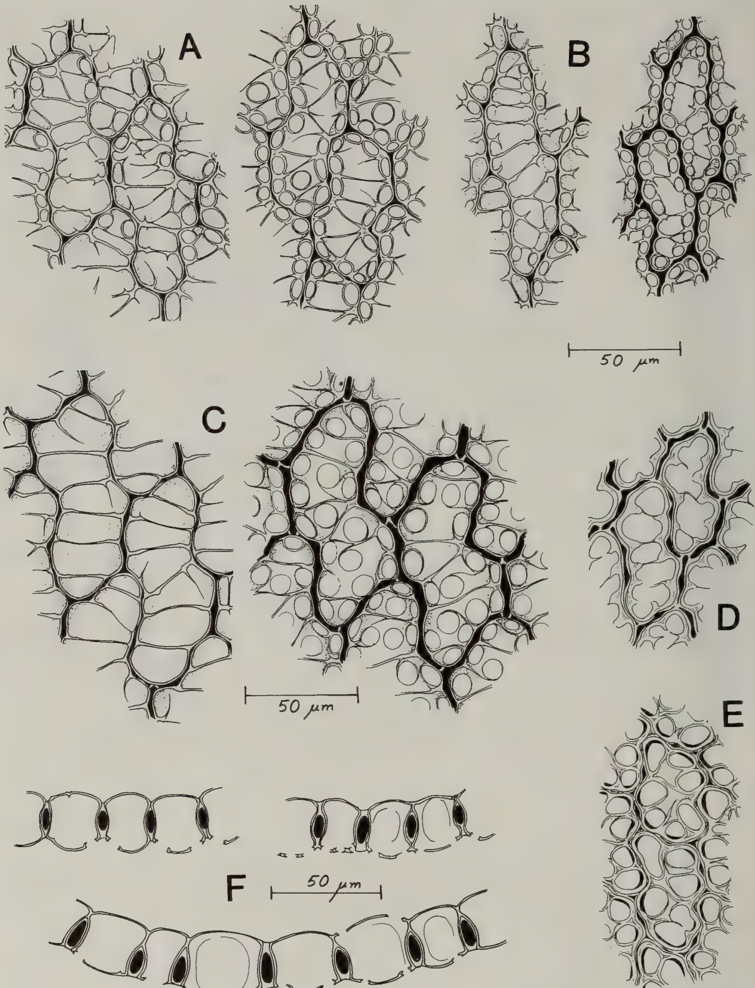

Fig. 27 *Sphagnum capense* Hornsch. A–C, adaxial (left figs) and adaxial (right figs) surfaces of branch leaves; D, adaxial surface of stem leaf; E, abaxial surface of stem leaf; F, transverse sections of leaves (A drawn from *Rehmann* 17c; B from the type collection; C from *De Sloover* 17. 625; D, E from the type collection and F from various sources).

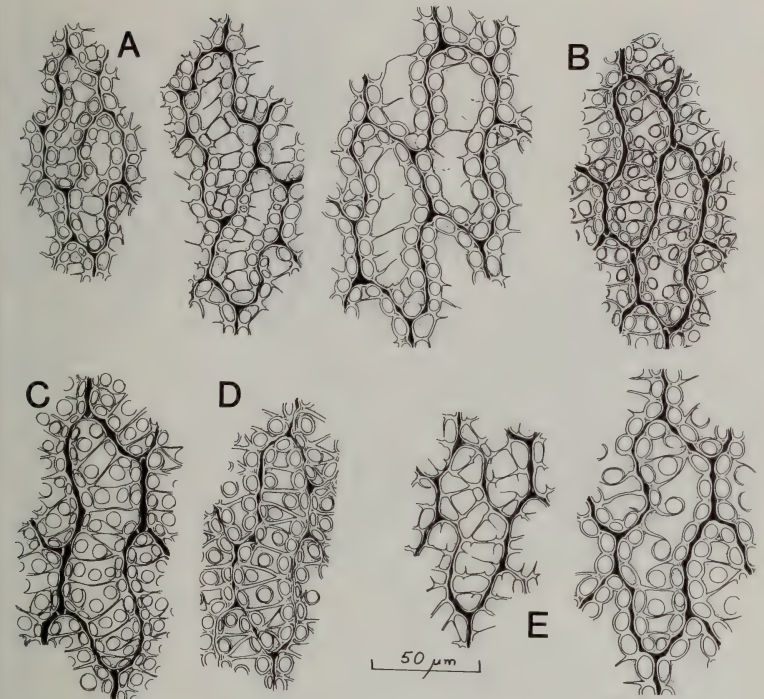

Fig. 28 *Sphagnum capense* Hornsch. A, abaxial (left) and adaxial (right) surfaces of branch leaf, amphiporose form; B, adaxial (left) and abaxial (right) surfaces of branch leaf, amphiporose form; D, E, abaxial surface of branch leaves, exceptionally multiporose forms; E, adaxial (left) and abaxial (right) surfaces of branch leaf, average form (A drawn from *Rehmann* 433; B from *Lacey* 65; C, from *P. de la Bathie* 12127; D from *De Sloover* 17.660; and E from *Mitchell* 375).

Plants small and delicate, green in shade but usually tinged with orange-brown and commonly the whole plant orange-brown, sometimes suffused with reddish-purple. *Fascicles* dense or remote, with 2–4 branches which vary in vigour and intensity of pigmentation but are not at all dimorphic. Stronger branches 4·0–10·0(–13·0) mm long. *Stems* 0·4–0·8 mm diameter. Cortex well developed, of 2–3(–4) layers of leucocysts, the outermost up to 45 μ wide and usually with a large pore in the outer wall. Internal cylinder well developed, normally brown. *Branch anatomy*. Cortical cells markedly dimorphic; retort cells usually in linear pairs, highly inflated and with the pores at ends of conspicuous protuberances. Internal cylinder yellow to deep brown. *Stem leaves* relatively large, larger than branch leaves, ovate-lingulate, 1·2–1·9 mm long, 0·7–0·9 mm wide, fibrillose in the upper half, sometimes almost or quite to insertion. Upper fibrillose tissue identical to that of branch leaves, lower tissues variable, usually the leucocysts with 1–2 resorption gaps or enlarged pores. Border narrow, not expanded below. Leaf apex variable, from narrowly truncate and dentate, apparently mucronate due to 'pinched in' margins, to long,

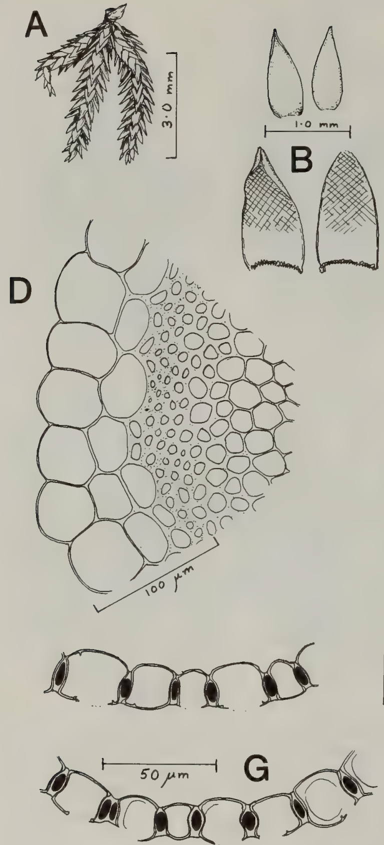

Fig. 29 *Sphagnum capense* Hornsch. A, branch fascicle; B, branch leaves (above) and stem leaves (below); C, adaxial (left) and abaxial (right) surfaces of branch leaves; D, transverse section of stem; E, abaxial surface of non-resorbed branch leaf cells; F, branch cortex; G, transverse sections of branch leaves (all drawn from the type of *S. islei*).

wide-ovate, very concave; apices truncate-dentate, less commonly narrow and more or less mucronate, occasionally eroded; border narrow, typically of a single series of cells, with or without resorption of the outer wall near the leaf apex. *Leucocysts* relatively short and wide, 18·0–25·0 × 70·0–110·0 μm in upper mid-leaf; sometimes with a marked tendency to have partial loss of fibrils; pores very variable; typically, abaxial surface with very numerous, ringed pores in series along the commissures, commonly with one to several additional free pores in, or near, the cell midline; adaxial surface sometimes devoid of pores (usually at least some pseudopores) but usually with 1–few pores near the commissures, especially at the cell angles, rarely with very

numerous adaxial pores and only exceptionally with as many or more adaxial than abaxial pores; pores 3·0–6·0 μm diameter. *T.S. leaf.* Leucocysts convex on both sides, sometimes more strongly so adaxially. Chlorocysts narrow, oval to urceolate, mainly enclosed on the adaxial side but very narrowly exposed abaxially via a thick, refractive wall: less frequently chlorocysts reaching adaxial surface, or chlorocysts completely enclosed both abaxially and adaxially, but then always more deeply so adaxially. *Dioecious.* Antheridial bracts more or less indistinguishable from branch leaves but fibrils usually lost in lower half of bract. Female bracts large and convolute, ovate to ovate-lingulate, very concave, apices obtuse to sub-acute, not resorbed; tissue fibrillose almost to insertion and resembling that of branch leaves. Fruit rather rare; spores yellowish, rugulose, 34–38 μm diameter.

Distribution. Growing in low mats on acid, flushed mineral or, rarely, organic substrates at medium to high altitudes, rarely below 500 m alt. Local to locally frequent in southern Africa from Cape Province to Mozambique, becoming rarer in the more northerly regions of East Africa; several records from the East African islands.

Southern Africa. CAPE PROVINCE: 'In der Kluft nach dem Gipfel des Tafelberges', *Ecklon* s.n. (BM, H, PC – lectotype collections of *S. capense*); 'An einer kleiner Quelle', *Ecklon* s.n. (H, PC); 'Dutoitskloof am Wasserfalle', 1600 ft. alt., *Drège* s.n. (BM, PC); Clarkson, *Breutel* s.n. (BM); Table Mountain, *Rehmann* exs. 15 (BM, PRE – collections of *S. panduraefolium*), exs. 16, 16b, 16c (= *Rehmann* 433, 433b, 433c) (BM, H, PC, PRE – syntype collections of *S. austro-molle*), exs. 17c (BM, etc.); Stinkwater, *Rehmann* exs. 18 (H, fertile); 'Prom. bon Spei', *Berguis* s.n. (H, as 'S. patens Brid.' in herb. S. O. Lindberg). Also many other more recent collections from the Table Mountain–Devil's Peak–Montagu Pass region, where the species and collectors are frequent, including: *Almborn* 5241a, b (PRE); *Eddy & Sims* s.n. (BM); *Esterhuysen* 15362, 15427, 15431, 15560 (BM); *Garside* 74 (PRE); *Goldblatt* 1357c (PRE); *Howes* 8 (PRE); *Humbert* s.n. (PC); *Magill & Schelpe* 3072 (H, PRE); *Marshall & Crosby* 8128 (PRE); *Pillans* 3545 (BM); *Rodin* 3235 (BM); *Schelpe* 3811, 3865, 3869, 3882 (BM); *Schyff* 5826 (PRE); *Sim* 9120, 9139, 9276, 9417, 9465, 9486 (PRE); *Spielhaus,* 1875 (BM); *Townsend* 82/196; *Van Zinderen Bakker* Blf. -U. 17458, 17458A (fertile and fruiting), 17745 (PRE); *Vorster* 450, 461, 664, 942, 943, (BM); *Wager* 88, 311, 511, 591 (BM, PRE); *Webster* 353 (BM); *Weintraub* 10301 (BM, fertile); *Wilman* 535 (PRE); *Wilms* 2603, 2629 (BM). TRANSVAAL: Drakensberg, Mt. Anderson, 2200 m alt., *Humbert* s.n. (PC); Mt. Kroatlamba, MacMac, *Maclea* s.n. (H).

Mlanje/Chimanimani. MALAWI: Mlanje Mt., 2000–2200 m alt., *Humbert* s.n. (BM, PC); *Lacey* 65 (BM); *Lupton* 193 (BM); *Wilman* 1369/52A (PRE). ZIMBABWE: Chimanimani Mts., 6000 ft [2000 m] alt., *Mitchell* 375 (BM); Nyumkombe, in cascade over ledge of rock, *Gilliland* 893 (BM).

East African Islands. MADAGASCAR: 'sous-bois de la région centrale', 2000 m alt., *P. de la Bathie* 12127 (BM); Vakinankaratra, near summit of Triafajarona, 2575 m alt., *Viguier & Humbert* 1582 (PC), *Viguier & Humbert* 1588 (PC – type collection of *S. humbertii*). RÉUNION: Cirque de Cilaos, 1950 m alt., in bryophyte carpet on wet talus, *De Sloover* 17.625, 17.660, 17.875 (BM, NAM). AMSTERDAM ISLAND: *G. de l'Isle* 42 (BM, PC – type collections of *S. islei*).

This delicate and rather neat species belongs to a group of section *Subsecunda* which is almost exclusively African in its occurrence. The group is characterised by the possession of a strongly developed, 2–4-layered cortex and ovate leaves with wide, multi-porose leucocysts. Associated features are the generally short, numerous, markedly 5-ranked branch leaves, large stem leaves, and highly developed retort cells. *S. capense* is closely related to *S. pycnocladulum* and it may not always be possible to distinguish between the former species and underdeveloped states of the latter. Garside (1949) was rather ambiguous in his treatment of *S. pycnocladulum*, implying at one point that it is simply a robust expression of *S. capense*, nevertheless listing both as distinct species in his text. *S. capense* is, on average, a distinctly more delicate plant than *S. pycnocladulum,* never has more than 4 fully developed branches per fascicle, and only exceptionally has pseudomucronate branch leaves. *S. davidii*, another African species of the group, is usually more robust, has usually 5 or more branches per fascicle, and has chlorocysts narrowly and equally exposed on both sides of branch leaves. *S. ceylonicum* has adaxially displaced chlorocysts and usually proportionately narrower leaves.

Variation within the species is mainly in the number and distribution of the pores in the leaves. The pores are, on average, larger and more regular in form than those of other section *Subsecunda*, averaging 4–6 μm diameter, occasionally up to 10 μm. The tendency to have

additional free pores in the cell midline is a characteristic of *S. capense* and its relatives, but has been noted also in *S. africanum* (distinguished by its almost uniseriate cortex). The degree of chlorocyst exposure is also variable, from those plants in which there is narrow adaxial, but wider abaxial exposure to forms with adaxially immersed chlorocysts.

S. panduraefolium C. Müll. is a juvenile or etiolated plant with poorly developed branches and large stem leaves. Populations from the East African islands include exceptionally small plants with excessively perforate leaves, but these are matched by some of the collections from Mlanje. Such plants are not considered to merit taxonomic distinction.

13. Sphagnum pycnocladulum C. Müll.
(Figs 30–32)

in *Flora, Jena* **70**: 420 (1887). Type: S. Africa, 'Montagu Pass ad cataractam', *Rehmann* (1875); *Musci austro-africani* 13 (1878–1879) (BM). – *S. pycnocladulum* var. *viride* Warnst., *Sphagnol. univ.*: 176 (1911). – *S. pycnocladulum* var. *fuscescens* Warnst., *Sphagnol. univ.*: 176 (1911).
S. beyrichianum Warnst. in *Hedwigia* **36**: 157 (1897).
S. goetzeanum Warnst. in *Hedwigia* **47**: 98 (1907).

Plants medium-sized to rather robust, rarely small and delicate, green, yellowish to brown. *Fascicles* usually spaced at 2–4 mm on stems, rarely closely packed, composed of at least 5, commonly 6 or even 7 branches. Branches 8·0–18·0 mm long, uniformly foliate, varying in length but not dimorphic, although weaker 2–4 branches more or less pendent. *Stems* rather rigid, 0·6–0·9 mm diameter; cortex well developed, of 2–3 layers of thin-walled leucocysts, the outer layer usually with single pores or thinnings; internal cylinder rather thick, yellowish to dark brown. Branch cortex dimorphic; retort cells in linear pairs or occasionally threes, highly inflated and moderately protuberant at apertures. *Stem leaves* varying in attitude, usually more or less spreading, larger than branch leaves, 1·0–1·8 mm long, 0·7–0·9 mm wide, varying from triangular-ovate (heterophyllous forms) to ovate-lingulate; apex variable, from pseudo-mucronate (hemiisophyllous forms) to rounded-obtuse and eroded; border 2–4 cells wide, not expanded towards leaf base. Leaf tissue variable in extent of fibrillation: typically fibrillose only in the upper half, not rarely almost or quite to insertion, exceptionally devoid of fibrils. Upper fibrillose tissue more or less identical to that of the branch leaves, lower tissues with one to several resorption gaps, mainly towards cell ends. *Branch leaves* very regular in size and disposition, markedly 5-ranked, ovate and very concave, 0·8–1·4 mm long, 0·8–1·0 mm wide; apices narrow, more or less abruptly tapered to acute, or narrowly truncated, more or less dentate tips, always appearing more or less mucronate because of the strongly involute upper margins (virtually impossible to flatten under a cover glass). Border narrow, without resorption furrow. *Leucocysts* 18·0–25·0 μm wide, 80–130 μm long in upper mid leaf; fibrils on abaxial side often very irregular and sometimes more or less suppressed in the middle part of cells. Abaxial surface with small to medium-sized pores (3·0–5·0 μm diameter) more or less in series along the commissures, with or without 1–5 additional pores in, or near, the cell midline. Adaxial surface without pores, or pores few; cell often appearing reticulate with ramifying fibrils and more or less pseudoporose. *T.S. leaf.* Chlorocysts narrow, with oval lumina, very narrowly exposed on abaxial leaf surface, usually shallowly immersed or just reaching adaxial side. *Dioecious.* Antheridial branches virtually indistinguishable from sterile branches. Inner perichaetial leaves large, *c.* 4·5 × 2·5 mm, ovate and more or less acute, fibrillose to below the middle. Fruit very rare; spores 34–36 μm diameter, more or less rugulose-papillose.

Distribution. In and around acid springs and mires; rare and of scattered occurrence from western Cape Province to Ruwenzori.

Southern Africa. CAPE PROVINCE: Montagu Pass, *Rehmann, Musci austro-africani* 13 (BM – type collection of *S. pycnocladulum*). TRANSKEI: Pondoland, 'mooringe Land auf Sandstein', *Beyrich* s.n. (BM, H – type collections of *S. beyrichianum*).

Mlanje/Chimanimani. MALAWI: Usafua, 2200 m alt., *Goetz* 1301 (BM – type collection of *S. goetzeanum*); Mlanje, Likabula Valley, *Lacey* 52 (BM); Mt. Mlanje, 6300 ft [*c.* 1900 m] alt., *Davy* 2088 (BM).

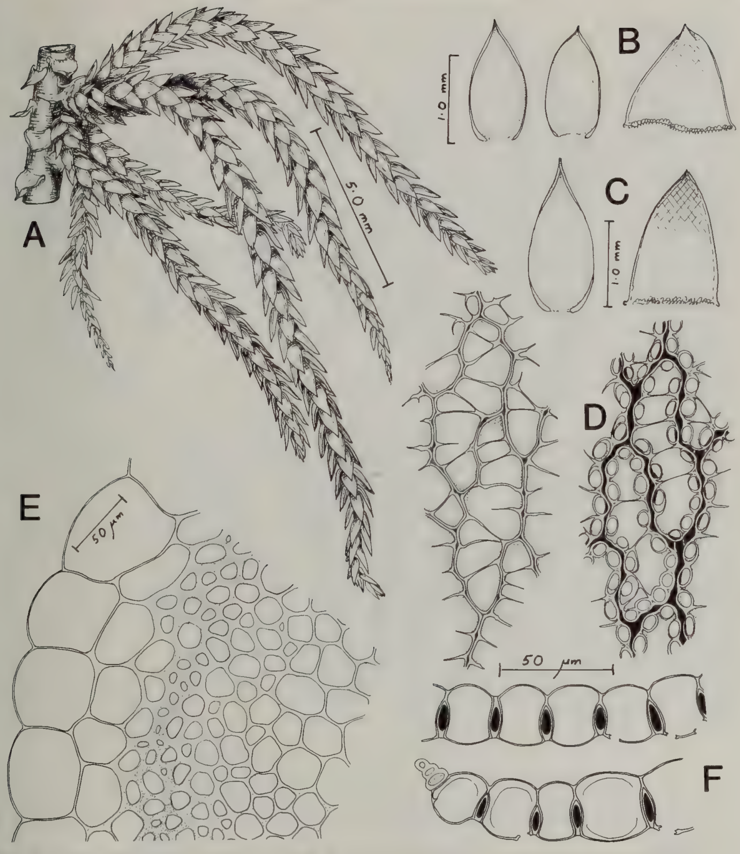

Fig. 30 *Sphagnum pycnocladulum* C. Müll. A, branch fascicle; B, C, branch leaves (left figs) and stem leaves (right figs); D, adaxial (left) and abaxial (right) surfaces of branch leaf; E, transverse section of stem; F, transverse section of branch leaf (all drawn from the type collection).

Ruwenzori/Usambara. RWANDA: Rugege, between Mt. Yahahi and Mt. Bigugu, 2450 m alt., *De Sloover* 13786 (BM, NAM), 19093 (BM).

The type collection consists of a robust, rigid, very distinctive plant which superficially bears a strong resemblance to robust forms of *S. tumidulum*. On the other hand, the weaker expressions, including '*S. beyrichianum*' forms, have a facies much more like that of *S. capense*. Garside (1949) was ambivalent in his treatment of the taxon, but held the opinion that *S. pycnocladulum* (which he interpreted more widely than the present author) was the mature, female phase of *S. capense*. As a result, most fruiting plants of *S. capense* were identified by him

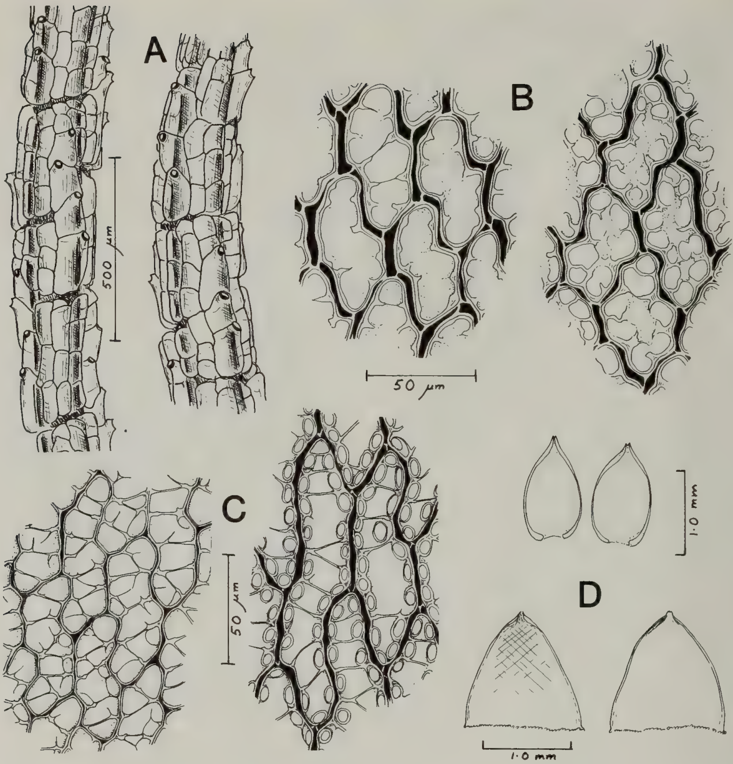

Fig. 31 *Sphagnum pycnocladulum* C. Müll. A, branch cortex; B, adaxial (left) and abaxial (right) surfaces of stem leaf in supapical leaf region; C, adaxial (left) and abaxial (right) surfaces of branch leaf; D, branch leaves (above) and stem leaves (below) (drawn mainly from the type collection of *S. goetzeanum*).

as *S. pycnocladulum*. While the two taxa are indisputably closely related, and allowing that *S. pycnocladulum* is a not altogether satisfactory species, the latter is usually easily identified by its more or less mucronate leaves and at least some fascicles bearing 5 or more branches. Furthermore, while unequivocal plants of *S. capense* have been collected in fruit on a number of occasions, the well marked examples of *S. pycnocladulum* available for study are apparently all barren.

14. Sphagnum ericetorum Brid.
(Fig. 33)

Sp. musc. **1**: 19 (1806). Type: Réunion, Plaine de Chicot, *Bory de Saint-Vincent* (B).

Plants identical in habit to the less robust forms of *S. pycnocladulum* but differing in the

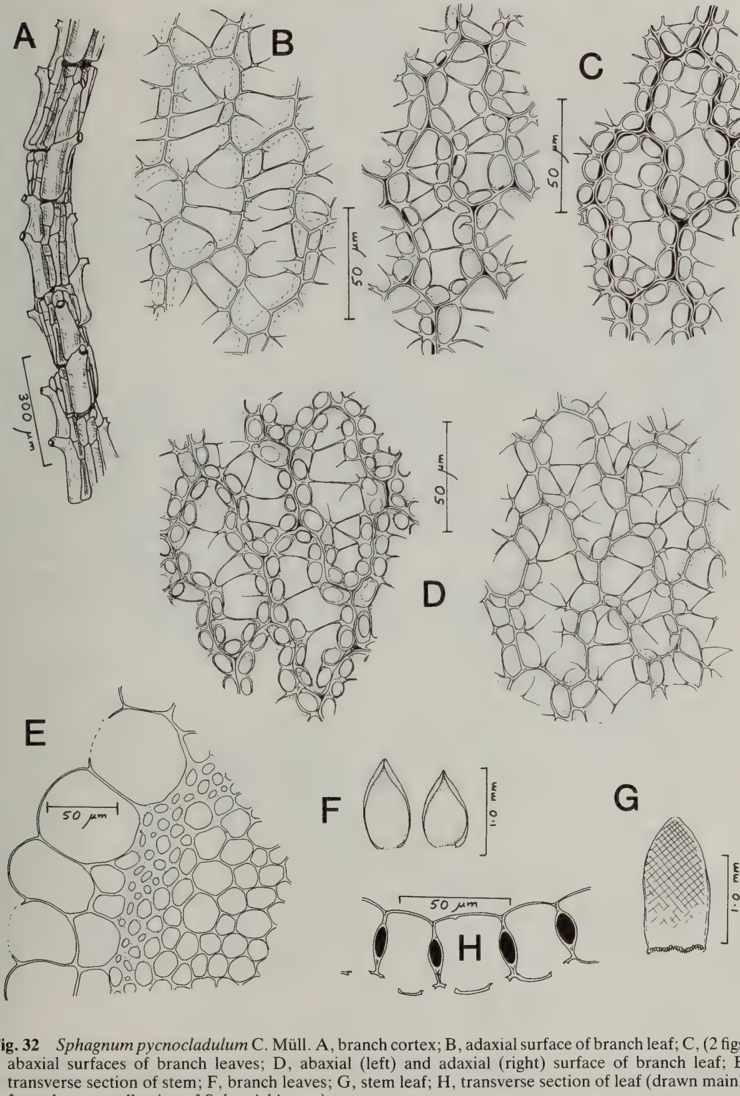

Fig. 32 *Sphagnum pycnocladulum* C. Müll. A, branch cortex; B, adaxial surface of branch leaf; C, (2 figs) abaxial surfaces of branch leaves; D, abaxial (left) and adaxial (right) surface of branch leaf; E, transverse section of stem; F, branch leaves; G, stem leaf; H, transverse section of leaf (drawn mainly from the type collection of *S. beyrichianum*).

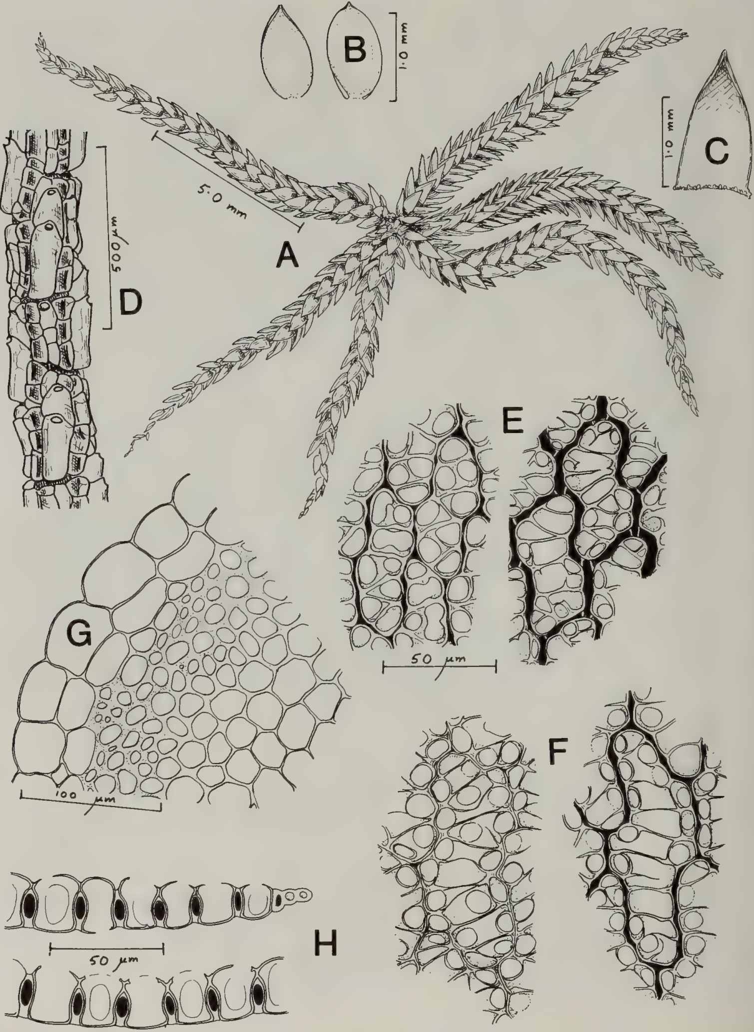

Fig. 33 *Sphagnum ericetorum* Brid. A, branch fascicle; B, branch leaves; C, stem leaf; D, branch cortex; E–F, adaxial (left) and abaxial (right) surfaces of branch leaf; G, transverse section of stem; H, transverse sections of leaf (A, D and E drawn from *Bosser* 9501; the remainder from the holotype).

following points: stem leaves usually proportionately larger and more isophyllous in character, ovate-lingulate, 1·8–2·5 mm long, fibrillose almost or quite to insertion. Leucocysts of branch leaves with few or no true pores on the abaxial side (but often with abundant pseudopores); adaxial surface with abundant, medium-sized, ringed pores, 6·0–10·0 μm diameter, along the commissures, with or without a few additional free pores in or near the cell mid-line. Chlorocysts occasionally enclosed abaxially as well as adaxially.

Distribution. Endemic to the East African islands, where it is apparently rare. Scanty data indicate that the plant occurs in wet heathlands at high altitudes.

East African Islands. MADAGASCAR: Massif de l'Andringitra, 2000–2500 m alt., *Humbert* 98 (PC, also a specimen numbered '28' in herb. Cardot); Massif du Tsaratanana, 2300–2875 m alt., *Humbert* s.n. (PC); Vakinankaratra, near summit of Triafajarona, 2575 m alt., *Viguier & Humbert* 1588 p.p. (PC). RÉUNION: Philippia, 2000 m alt., *Bosser* 9501 (BM, PC).

It is with some hesitation that *S. ericetorum* is treated as a species rather than a subspecies or variety of *S. pycnocladulum*. The characters that discriminate the two taxa, while making identification a relatively simple operation, are themselves so variable in the other taxa of the *S. capense* complex that it is inconsistent to give them greater emphasis here. Although there do not appear to be intermediate facies between *S. ericetorum* and *S. pycnocladulum*, the situation is in many respects analogous to that existing between *S. chevalieri* and *S. davidii* (which are treated here as simply synonyms). However, if united below the level of species, *S. ericetorum* would take precedence over *S. pycnocladulum*. Bridel's (*loc. cit.*) original diagnosis is quite inadequate to circumscribe a plant which, at that time, was apparently represented solely by the type specimen in his own herbarium (B). Subsequently, and not surprisingly, many and diverse plants were erroneously identified as *S. ericetorum*, and the situation remained confused until the present time. On the other hand, while the specific status of *S. pycnocladulum* may be regarded as equivocal by some, its identity is reasonably well established, and since both taxa are rare, it is considered practical here to maintain the nomenclatural *status quo* by retaining *S. ericetorum* at species level.

Ventriporose forms of *S. davidii* are distinct in their median chlorocysts having equal exposure on both branch-leaf surfaces, while *S. tumidulum* var. *confusum* is separable by its immersed chlorocysts and pseudomucronate stem leaves with distinctly expanded borders.

15. Sphagnum ceylonicum Mitten ex Warnst.
(Fig. 34)

in *Hedwigia* **29**: 195, tab. 4 fig. 7, tab. 7 fig. 14 (1890). Type: Sri Lanka (Ceylon), *Thwaites* 262 (BM).
S. kerstenii Hampe in Warnst., *Sphagnol. univ.*: 135, fig. 30C (1911).
S. keniae Dixon in *Smithson. misc. Collns.* **69** (2): 7, pl. 1 fig. 1 (1918).
S. vandenbroeckii Nav. in *Natuurw. Gijdschr.* **4**: 144 (1922).
S. ugandense J. Taylor & A. Thompson in *Kew Bull.* **9**: 517 (1955).

Plants medium-sized or rather small, lax or dense, green variegated with brown and orange or whole plant orange-brown. *Fascicles* distant or closely set, with 5–7 branches; branches rather short to elongated and tapering, the strongest 9·0–18·0 mm long, monomorphic. *Stems* 0·6–0·8 mm diameter, yellowish to deep brown; cortex well developed, of 2(–3) layers of thin-walled leucocysts, the outer layer usually, at least in part, uniforaminate. *Branch cortex* dimorphic; retort cells in linear pairs slightly protuberant at apertures; sometimes, here and there, other cortical leucocysts also porose. Internal cylinder pale to dark brown. *Stem leaves* relatively large, lingulate to oval-lingulate, 1·8–2·6 mm long, 0·9–1·2 mm wide, fibrillose to below mid-leaf, often to leaf base; border 2–4 cells wide, evanescent at the eroded, rounded-obtuse leaf apex, not expanded below. Upper fibrillose tissue identical to branch-leaf tissue. *Branch leaves* basically 5-ranked, often markedly so, varying from short and widely ovate to longer and ovate-lanceolate, 1·0–2·1 mm long, 0·7–0·8 mm wide; apices narrowly truncate-dentate but usually appearing acute or pseudomucronate; border narrow, not resorbed. *Leucocysts* rather narrow to relatively short and wide, mainly 20–30 × 90–120 μm; abaxial surface multiporose; pores small to medium-sized, circular, ringed, 5·0–8·0 μm diameter on average, in series along

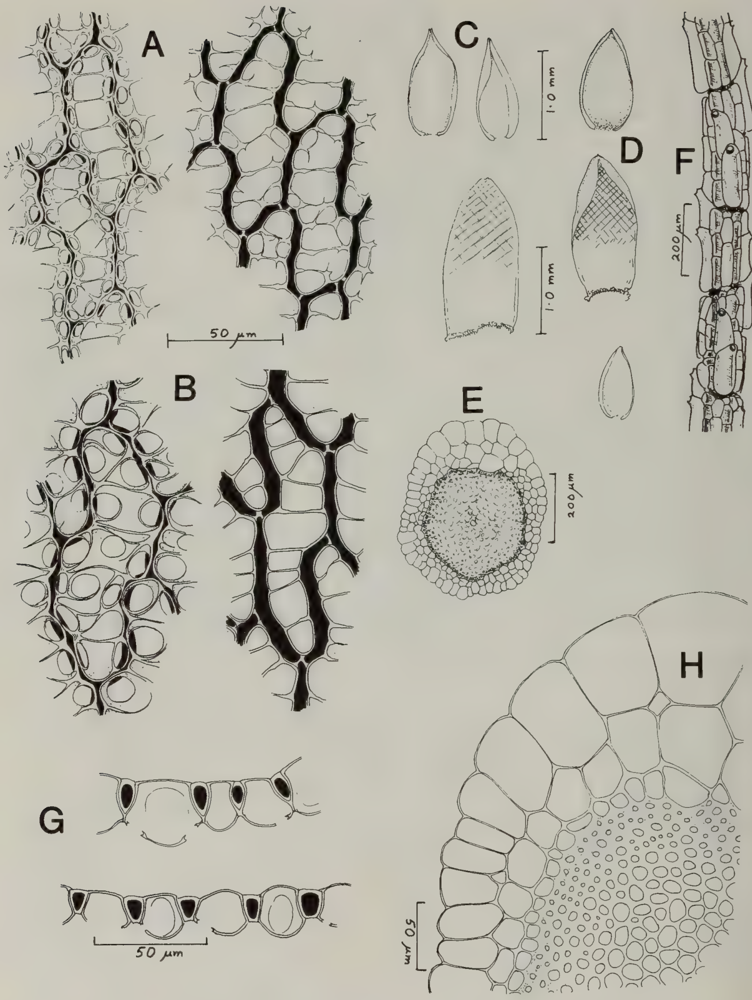

Fig. 34 *Sphagnum ceylonicum* Mitten ex Warnst. A, B, abaxial (left) and adaxial (right) surfaces of branch leaves; C, D, branch leaves (upper figs) and stem leaves (lower figs) and one pendent-branch leaf (lowermost fig.); E, transverse section of stem (low magnification); F, branch cortex; G, transverse section of branch leaves, H, transverse section of stem (A, C, G drawn from the type of *S. keniae*; the remainder from the type of *S. ugandense*).

the commissures and usually 1–6 or more free pores near the cell mid-line. Adaxial surface without pores or pores relatively few. *T.S. leaf.* Leucocysts more strongly inflated adaxially. Chlorocysts varying from narrowly trapezoid to narrowly urceolate, thick-walled with more or less oval lumina, with widest exposure on the adaxial side, varying from narrowly exposed to shallowly enclosed on the abaxial side. *Dioecious* (presumably). No male plants seen. Female plants not rare, but only unfertilized specimens so far available.

Distribution. A local and apparently rare species, more or less confined to high altitudes, in East Africa, the East African islands, and Sri Lanka.

Ruwenzori/Usambara. UGANDA: Kigezi, Magahinga, in crater swamp at 3650 m alt., *Lind* 12 (BM – type collection of *S. ugandense*). KENYA: Mount Kenya, 4000 m alt., *Rune* s.n. (H); Mount Kenya, 3630 m alt., *Mearns* 1560 (BM – holotype of *S. keniae*); Teleki Valley, 3000–4000 m alt., *Stuart* s.n. [R.A.F. Lyneham Exped., 1980] (BM).

East African Islands. MADAGASCAR: Andohahelo, rocks at summit, 1900 m alt., *Humbert* s.n. (PC). RÉUNION: *Kersten* s.n. (BM, herb. Hampe – type collection of *S. kerstenii*); 'Enclos de la Fournaise, Piton du Crac', bog in sunlight, 1400 m alt., *Gimalac* 71.R.8501 (BM, NAM); 'Sentier du Tremblet au sud de la Fournaise', 2000 m alt., *Gimalac* 71.R.8004 (BM, NAM).

S. ceylonicum closely resembles *S. davidii* but with a tendency to have slightly longer leaves drawn to finer apices. It is, however, very variable in this respect, and the only safe discriminating character is the position of the chlorocyst with distinctly adaxial exposure.

The branch-leaf pores of this, and other, species of the *S. capense* group are larger on average than those usually met with in section *Subsecunda.* In addition, the multi-layered hyaloderm, and in the case of *S. ceylonicum* the adaxially biased chlorocysts, suggest an approach towards section *Acutifolia.* In fact, Warnstorf (1911) and later Taylor & Thompson (1955) placed *S. ugandense* (= *S. ceylonicum*) in the latter section. Clearly there could be no question of including either *S. pycnocladulum* or *S. capense* in section *Acutifolia*, two species very closely related to *S. ceylonicum*. Juvenile states of all species of the *S. capense* group show very clearly their affinities with section *Subsecunda.*

Section *CUSPIDATA*

Sphagnum sect. ***Cuspidata*** (Lindb.) Schimper, *Syn. musc. eur.* 2nd ed.: 829 (1876).

Plants very variable but usually pale and commonly very flaccid; secondary pigments, if developed, yellow to brown, never red. Stem hyaloderm sometimes rather indistinct, never foraminate. Fascicles commonly not, or only weakly dimorphic. Retort cells of branch hyaloderm usually well developed, typically in linear groups of 2–3, rarely solitary. Stem leaves very variable, isophyllous to markedly heterophyllous. Branch leaves lanceolate to linear. Branch-leaf leucocysts typically narrow and pauciporose on the abaxial side, adaxial pores usually unringed and more or less confined to the cell angles, rarely numerous and ringed. Chlorocysts in section more or less triangular to trapezoid, always displaced towards, and with only or widest exposure on the abaxial leaf face.

Distribution as in the genus.

This is a large and diverse section, well represented in the tropics as well as in the temperate zones. The African flora appears to comprise relict, endemic, and apparently primitive forms (e.g. *S. planifolium* agg.), in addition to more evolved plants that include incursions from other continental elements (e.g. *S. cuspidatum* from Laurasia and *S. cuspidatulum* from Malaysia), in addition to obvious neoendemics such as *S. slooveri*.

16. Sphagnum cuspidatum Ehrh. ex Hoffm.
(Figs 35–37)

Deutschl. Fl. **2**: 22 (1796).
S. bernieri Bescher. ex Ren. & Cardot in Grandidier, *Hist. phys. Madagascar* **39** (atlas, 4): plate 142 (1901).
S. ikongense Warnst. in *Magy. bot. Lap* **1**: 46 (1902).
S. aloysii-sabaudiae Negri in *Annali Bot.* **7**: 161 (1908).
S. gabonense Bescher. apud Warnst., *Sphagnol. univ.*: 269 (1911).

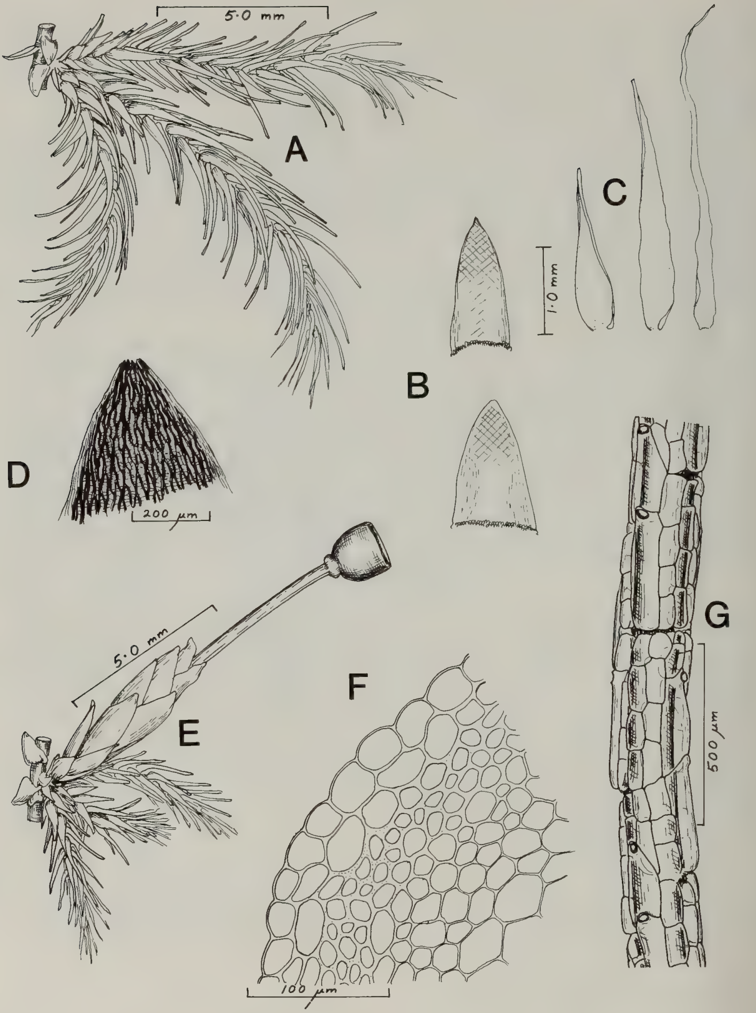

Fig. 35 *Sphagnum cuspidatum* Ehrh. ex Hoffm. A, branch fascicle; B, stem leaves; C, branch leaves (lower, middle and upper branch leaves, from left to right); D, apex of stem leaf; E, fascicle with female branch and empty capsule; F, transverse section of stem; G, branch cortex (E drawn from *P. de la Bathie* 7073; the remainder from the type collection of *S. ikongense*).

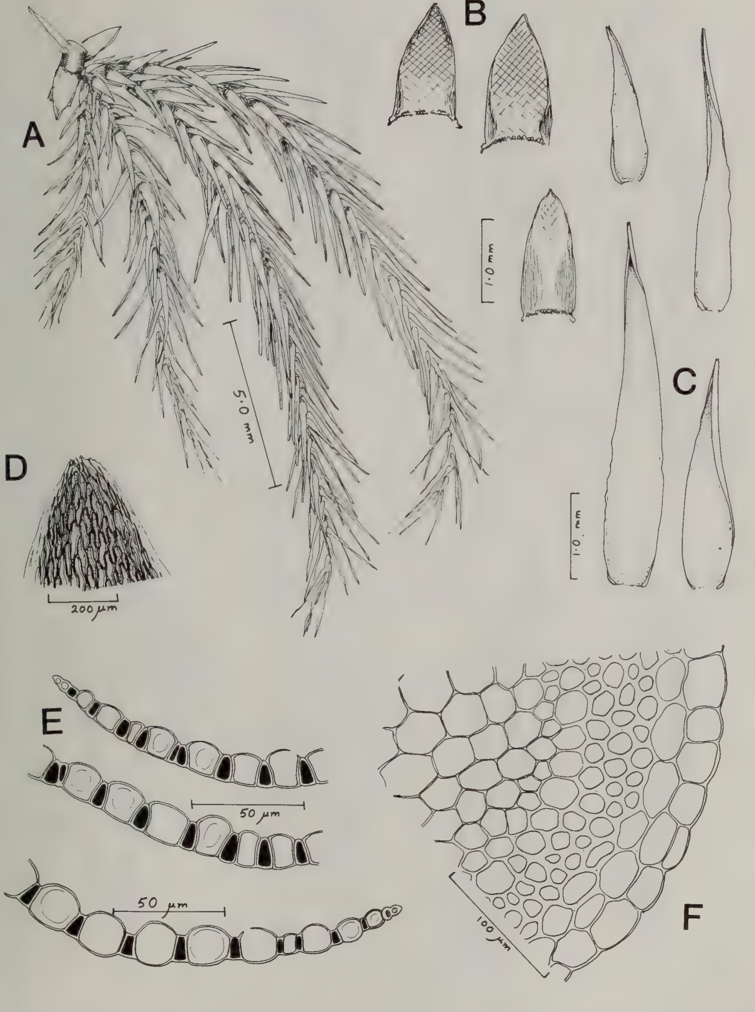

Fig. 36 *Sphagnum cuspidatum* Ehrh. ex Hoffm. A, branch fascicle; B, stem leaves; C, branch leaves; D, apex of stem leaf; E, transverse sections of leaves; F, transverse section of stem (drawn from the type collection of *S. bernieri*).

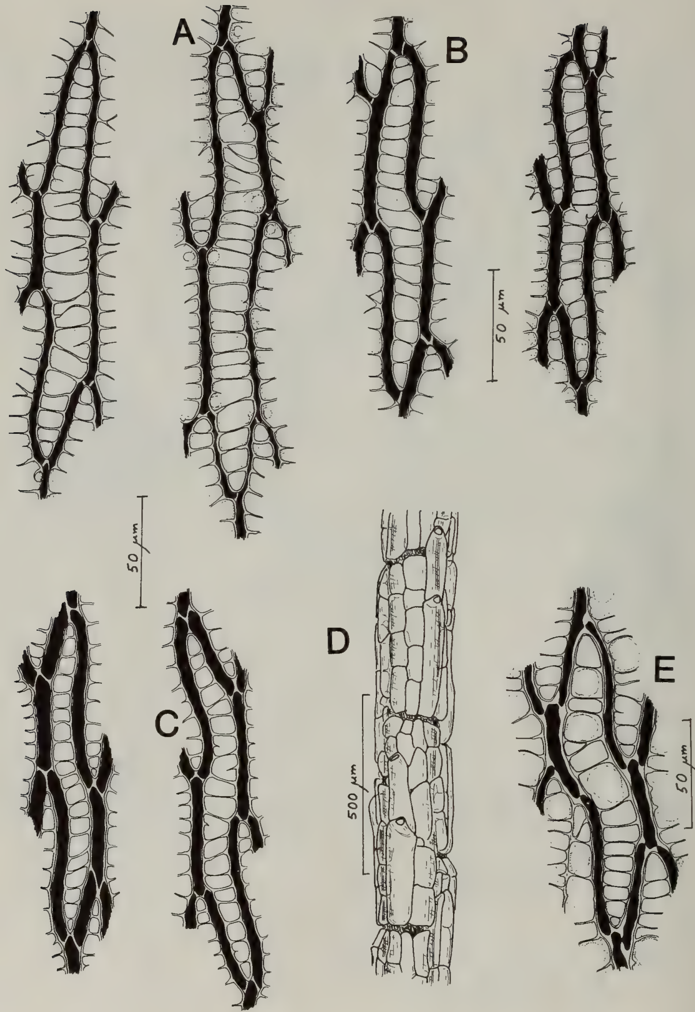

Fig. 37 *Sphagnum cuspidatum* Ehrh. ex Hoffm. A–C, abaxial (left figs) and adaxial (right figs) surfaces of branch leaves; D, branch cortex; E, adaxial surface of apical region of stem leaf (A drawn from the type of *S. bernieri*; B from the type of *S. gabonense*; C–E from *Humbert* 7855).

Plants small to medium-sized, rarely robust, flaccid but sometimes with brittle stems, green or almost colourless, with or without brownish or orange tints in young branch tips (especially in male plants). *Fascicles* variously spaced on stems, seldom closely packed, monomorphic but varying in vigour, 3–5 branches per fascicle, branches up to 26·0 mm but usually 12·0–20·0 mm. *Stems* pale, more or less lacking secondary pigments or, uncommonly, here and there pale brown (at least in herbarium specimens), 0·4–0·8 mm diameter. Cortex distinct, (1–)2–3 layered, the outer cells thin-walled or slightly incrassate, never with pores or thinnings in the external walls. Internal cylinder quite well developed, rather abruptly delimited internally, yellowish. *Branch* cortex dimorphic; retort cells distinct, usually in linear pairs, only slightly protuberant at apertures. Internal cylinder pale or pink or light brown (often only one branch in a fascicle has a pigmented cylinder). *Stem leaves* erect, spreading or reflexed, triangular-ovate, always longer than wide, (1·1–)1·2–1·6(–1·8) mm long (occasionally longer in juvenile or aberrant plants); apices rounded-obtuse to more or less truncate, dentate or eroded, sometimes slightly hooded or apparently mucronate due to inflexed upper margins. Border strong above, slightly to very strongly expanded below into patches of prosenchymatous tissue. *Branch leaves* conspicuously long and proportionately narrow, straight or somewhat curved and homomallous, basically 5-ranked but often only obscurely so; lowest leaves short and more or less ovate, the great majority narrowly lanceolate to linear, frequently appearing almost subulate due to inrolled margins; (1·3–)1·4–2·5(–3·0) mm long, 0·5–0·8 mm wide; apices truncate and 5–9-dentate; border strong, 2–4 cells wide. Hyaline cells long and narrow, 11·0–15·0(–20·0) μm long in mid-leaf; abaxial surface without pores or with a small pore in an upper lateral angle, with or without an inconspicuous resorption gap in the apical angle; pseudopores absent or frequent; adaxial surface normally porose but pores often only discernible after staining; pores 2–5(–6) per cell, adjacent to the cell angles, ringed or unringed, 2·0–4·0 μm diameter. *T.S. leaf*. Hyaline cells almost plane or shallowly convex abaxially, shallowly to strongly convex adaxially. Photosynthetic cells exposed on both sides of leaf, trapezoid in section, more or less thin-walled and with widest exposure on the abaxial side (sometimes almost as wide as hyaline cells). *Dioecious*. Male branches usually tinged orange or brown; perigonial leaves shorter and more concave but not essentially differing from sterile leaves. Inner perichaetial bracts very large, convolute, up to 5·0 mm long, *c.* 2·1 mm wide, usually fibrillose in a zone below apices and sometimes, erratically, elsewhere; apex truncate or retuse, prosenchymatous, not resorbed. Fruit very rare in African material; spores brown, coarsely papillose, *c.* 32·0 μm diameter.

Distribution. A widespread, circumboreal species occurring from subarctic to equatorial latitudes, most abundant in oceanic regions of Europe and eastern North America where the species occurs in terrestrial or aquatic states. In Africa *S. cuspidatum* occurs exclusively in a broad zone from Gabon in the west to Ruwenzori in the east, and on the larger islands in the Indian Ocean, mainly above 2000 m alt., except in the more oceanic parts of Malagasy where it descends almost to sea-level. The species is frequently fertile in temperate latitudes, but very rarely so in Africa.

West Africa. GABON: Fernan Vaz, *Walker* 77 (BM); *Duparquet* s.n. (PC – type collection of *S. gabonense*); 'Savanes dans la région de bas Ogooué', Binda, *Le Testu* 1597 (BM). CONGO REPUBLIC: Brazzaville, *Koechlin* 2694 (BM); South of Djambala, *Ncklés* s.n. (BM). ZAIRE: 'Lac Leopold II, à l'est de Bankaie', *Gilbert* 14767 (H).

Ruwenzori/Usambara. ZAIRE: Kivu, montane forest at 2200 m alt., *Humbert* 7855 (PC). RWANDA: Massif des Birunga (= Virunga), Karisimbi, in water in crater, 3850 m alt., *De Sloover* 13257 (BM, NAM); Gahinga, at summit crater, 3440 m alt., *De Sloover* 13542 (BM, NAM). UGANDA: Kigezi, swamp in crater, 3250 m alt., *Thomas* 2444 (BM).

East African Islands. MADAGASCAR: North of the island, *Bernier* s.n. (PC – isotype of *S. bernieri*); swamp in forest, east coast below Natitana, *P. de la Bathie* 7073 (PC, fruiting); Andovoranto, *Viguiér & Humbert* s.n. (PC); Port Dauphin, *Decary* s.n. (PC, fruiting); Midongy, Farafangana, 'bog in sunlight', *Decary* s.n. (BM); Tananarive, Mount Bity [Ibity?], 2000 m alt., *Cremers* 1972 (BM); Andondabe, submerged in bog, *Cremers* 2306 (BM); 8 km from Santa Suce, *Onraedt* 70.M.2000, 70.M.2001 (BM, NAM); Plateau d'Ikongo, *Besson* 313, 317 (PC – syntype collections of *S. ikongense*); Marais de Stampika, Ambongo, *P. de la Bathie* 7140 (PC); Antongil, marsh near the sea, *P. de la Bathie* 7113 (PC); Mt. Ibity, 2000 m alt., *P. de la Bathie* 7037 (PC).

In spite of considerable variation in vigour, degree of stem-leaf fibrillation, branch-leaf dimensions, and other morphological details, *S. cuspidatum* will rarely present any difficulty in identification. Branch-leaf shape alone will be sufficient in most cases to determine the species, only one other African taxon, *S. planifolium* var. *augustilimbatum*, approaching it in leaf shape. The distinctly expanded stem-leaf border of *S. cuspidatum* is a feature that is absent in all forms of *S. planifolium*.

From a genetic diversity point of view, vicariad taxa may have to travel a considerable distance before they can be confidently identified using purely morphological characters. Full expression of derived characters may be obscured, furthermore, in juvenile or ecologically repressed phases of growth. Taxonomic issues are complicated further by the propensity of *Sphagnum* to follow avenues of parallel or convergent evolution. *S. cuspidatum*, with regard to its tropical occurrences, exemplifies the kind of problem that may be beyond solution by traditional herbarium-taxonomical approaches. African populations, under such names as *S. bernieri*, *S. gabonense*, and *S. ikongense*, seem to fit perfectly well within the traditional interpretation of *S. cuspidatum*, even taking into account local tendencies towards minor modifications (e.g. larger, more extensively fibrillose stem leaves; less widened prosenchymatous patches of cells, etc.). The present author has been unable to find any morphological characters by which populations from Madagascar, Zaire, or Ruwenzori can be separated from boreal *S. cuspidatum*. If the suggested conspecificity is valid, then *S. cuspidatum* features distributional patterns that differ from all other sphagna, being the only holarctic species to be found also in tropical Africa south of the Sahara. Recalling that *S. cuspidatum* occurs also in tropical Asia (extending as far as New Guinea [Eddy, 1977]), then the species is either a) an old taxon (possibly pre-mid Cretaceous) that had already become widely distributed before the break-up of Pangea, or b) a very successful migratory species (it has been found in fruit in Madagascar, and is certainly commonly very fertile in its temperate range) that managed to infiltrate Africa after the closure of the Tethys, or c) the African material belongs to a cryptic 'doppel-gänger' and is in reality an endemic taxon superficially indistinguishable from the holarctic plant. The interpretation favoured by this author is that option a) pertains, *S. cuspidatum* being an old and genetically heterogeneous species, representing an ancient divergence from, e.g. *S. falcatulum* Bescher. (temperate S. hemisphere).

17. **Sphagnum planifolium** C. Müll.
(Figs 38–43)

in *Flora, Jena* **70**: 415 (1887). Type: 'Africa aequinoctialis occidentalis, prope flumen Gabun in Arthington-cataracta', *Büttner* 23 (B, destroyed).

Plants extremely variable, from small, pale and flaccid (resembling *S. cuspidatum*) to robust and tumid; secondary pigmentation absent or confined to youngest and male branches which may be tinged yellowish to brown. *Fascicles* rather distant to closely set, stem hidden or not; (3–)4–5 branches per fascicle of which 2–3 are pendent but not or only slightly dimorphic; branches 15·0–30·0(–40·0) mm long, finely tapering distally. *Stems* green, yellowish or pale brown, 0·3–1·1 mm diameter. Cortex distinct, of 2–3 layers of moderately inflated, thin-walled or commonly somewhat incrassate leucocysts; never with pores in the outer walls. Internal cylinder weak to well developed, yellowish to pale brown. *Branch cortex* dimorphic; retort cells distinct, in linear series of 2–4, only slightly protuberant at apertures. *Stem leaves* usually reflexed, triangular-ovate to triangular-lingulate, (1·1–)1·3–2·0 mm long, 0·7–1·2 mm wide at insertion, fibrillose to at least one third, commonly throughout; upper fibrillose tissue more or less identical to that of the branch leaves, lower tissues usually with numerous septa and enlarged, adaxial resorption gaps; apices rounded-obtuse, dentate or eroded, sometimes slightly cucullate; border not expanded into prosenchymatous patches. *Branch leaves* typically broadly lanceolate, becoming narrower distally, in weak plants all leaves more or less narrowly lanceolate to linear; spiral or partially to completely 5-ranked, incumbent or erect-spreading, not curved or homomallous, symmetrical; typically leaves range from 1·4–2·8 mm long, 0·6–1·2 mm wide, in weak plants 1·2–2·4 mm long, 0·4–0·8 mm wide. Border narrow, of 2 series of cells;

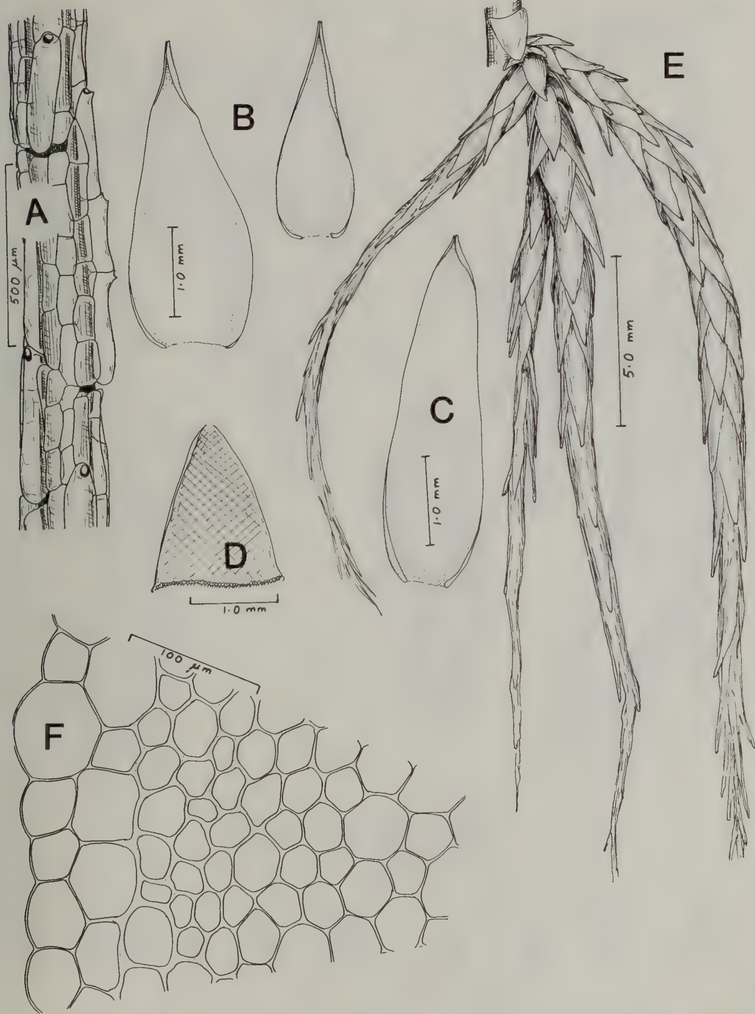

Fig. 38 *Sphagnum planifolium* C. Müll. var. *planifolium*. A, branch cortex; B, branch leaves; C, upper branch leaf; D, stem leaf; E, branch fascicle; F, transverse section of stem (all drawn from the type collection of *S. albicans*).

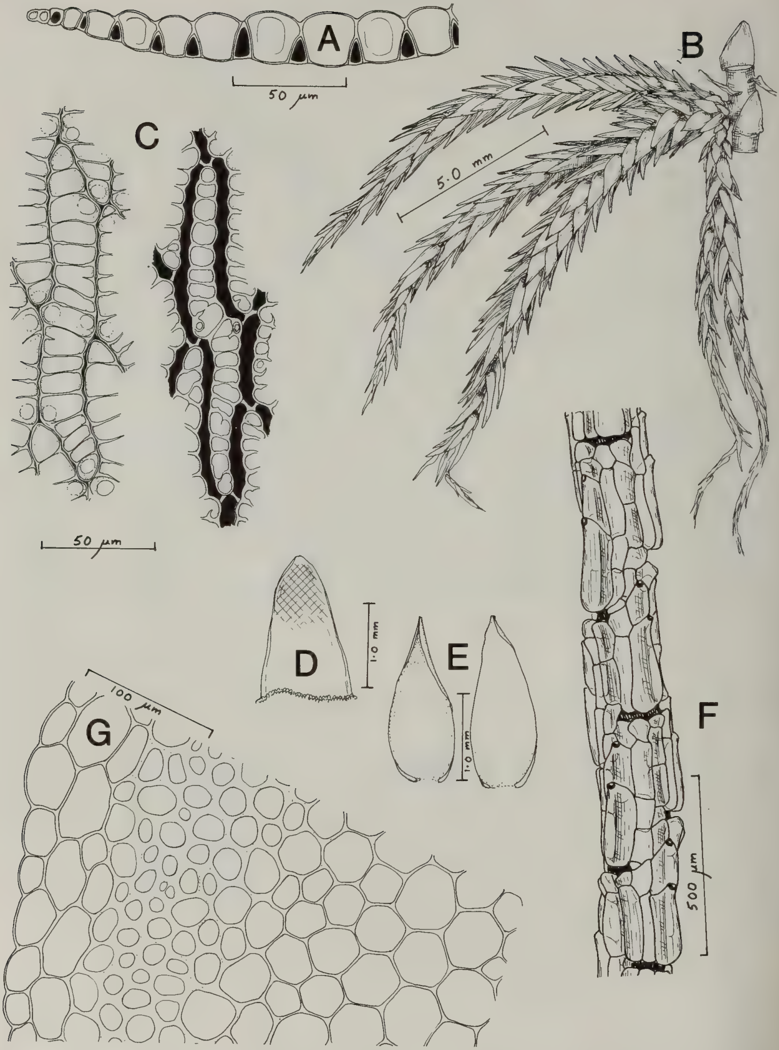

Fig. 39 *Sphagnum planifolium* C. Müll. var. *planifolium*. A, transverse section of leaf; B, branch fascicle; C, abaxial (right) and adaxial (left) surfaces of branch leaf; D, stem leaf; E, branch leaves; F, branch cortex; G, transverse section of stem (drawn from *Staudt* 876).

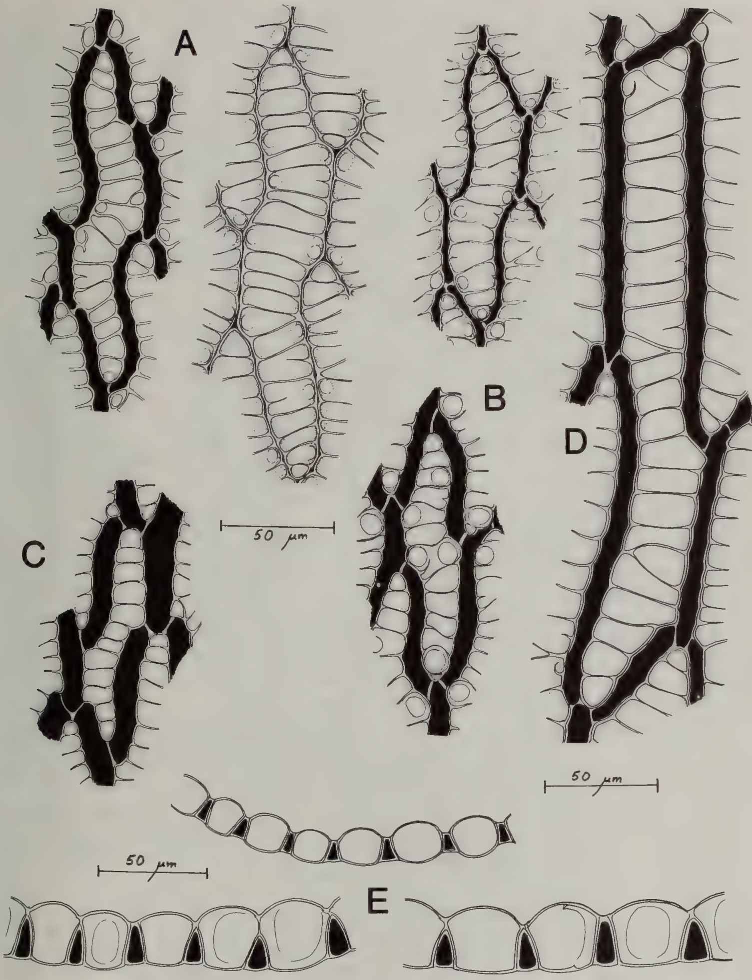

Fig. 40 *Sphagnum planifolium* C. Müll. var. *planifolium*. A, abaxial (left) and adaxial (right) surfaces of branch leaf; B, adaxial surface of branch leaf from mid leaf (upper fig.) and near apex of leaf (lower fig.); C, abaxial surface of stem leaf, upper fibrillose part; D, abaxial surface of branch leaf, lower-lateral leaf region. E, transverse sections of leaves from apical region of leaf (upper fig.) and mid leaf (drawn from various sources).

apex truncate-dentate, rather wide but often appearing narrow due to inrolled upper leaf margins. *Leucocysts*, in broader leaves 20–25(–35) μm wide, 100–180 μm long, in narrow leaves 12–20 × 90–180 μm. Abaxial surface sometimes without pores but with few to numerous pseudopores in the cell angles and scattered along the commissures, frequently 1– few small pores present, usually confined to the cell angles, and an inconspicuous resorption gap in the apical angle. Adaxial surface typically with a small to medium-sized, unringed or thin-ringed pore (*c*. 4·0–6·0 μm diameter) near (but not against) the commissure in most cell angles, rarely with additional pores scattered along the commissures. *T.S. leaf*. Leucocysts shallowly convex on the abaxial side, strongly convex adaxially. Chlorocysts triangular to trapezoid, always with much wider abaxial exposure and, in robust plants, frequently distinctly immersed on the adaxial side; cell walls more or less thin to distinctly incrassate, lumina oval-triangular. *Dioecious*. Male plants apparently very rare; perigonial leaves similar to normal leaves. Female plants apparently less rare, but no fertilized material seen, therefore no fully developed perichaetia were available for description; fruit and spores unknown.

Distribution. This species favours habitats with a high water-table, the most robust plants having been collected where these habitats are subject to high degrees of oceanicity. The main occurrences, judged on frequency of gatherings, are in the afromontane areas of Ruwenzori and Madagascar, with outlying stations in West Africa (Cameroon). There are no records of the species from southern Africa. See under varieties.

17a. Sphagnum planifolium var. planifolium
(Figs 38–40)

S. madegassum C. Müll. in *Flora, Jena* **70**: 415 (1887).
S. albicans Warnst. in *Hedwigia* **32**: 3, tab. 1 fig. 2 (1893).
S. bessonii Warnst. in *Hedwigia* **32**: 4, tab. 1 fig. 3 (1893).
S. cardotii Warnst. in *Hedwigia* **32**: 5, tab. 1 fig. 4, tab. 2 fig. 4 (1893).
S. pulchricoma Warnst. in *Bot. Zbl.* **82**: 44 (1900), *hom. illeg.*, non *S. pulchricoma* C. Müll. (1848).

Robust plants, with broadly lanceolate branch leaves and more or less adaxially immersed chlorocysts, accord well with Müller's taxon. Linear-lanceolate to linear branch leaves, in this form, are confined, when present at all, to the distal parts of branches. Stem leaves in the var. *planifolium* may be fibrillose throughout, but not infrequently have the basal portions efibrillose. Pores and pseudopores were not always distinguished by earlier authors, the latter (but not the former) sometimes being numerous on the convex leaf surfaces.

West Africa. IVORY COAST: 15 km east of Abidjan, *Guillaumet* 1887 (BM). CAMEROON: 'Johann Albrechts Höhe', *Staudt* 876 (BM). GABON: 'Wasserfall des Mougoungoulou auf dem Berg Iboundgi', *Le Testu* s.n. (BM – type collection of *S. potieri*, fragment only). ZAIRE: between Leopoldville and Labuka, *Laurent* 34; *Laurent* s.n., 1905 (BM, H, PC); marais de Boko, *Pynaert* s.n. (PC).

Southern Africa. CAPE PROVINCE: Little Winterhoek, *Lefson* 3312 (BM).

Mlanje/Chimanimani. ZAMBIA: Mwinilunga, on peaty soil among sedges, 1400 m alt., *Townsend* 75/146; Mpika, swamp on mountain slope, 1725 m alt., *Van Zinderen Bakker* 973 (BM, form approaching var. *rugegense*); Shiwa Ngandu, in swamp by river, 1400 m alt., *Van Zinderen Bakker* 890 (BM). ZIMBABWE: Melsetter District, source of Bundi River, 1800 m alt., *Chase* 6898 (BM).

Ruwenzori/Usambara. ZAIRE: Kivu, crater lake, Tchikesi, *Humbert* s.n. (PC); Shaba Province (Katanga), Kundelungu Plateau, 1700 m alt., *Townsend* 75/268, 75/283 (BM). RWANDA: 'Marais de la rivière Hikiberanya', Rugege, 2450 m alt., *De Sloover* 13789 (NAM); 'dans un ruisseau traversant un marais', Massif des Birunga (= Virunga), 2400 m alt., *De Sloover* 13703 (BM, NAM). UGANDA: Muhavura, Gahinga Pass, *c*. 9000 ft [2740 m] alt., in bog in open moorland, *Burtt* 2852 (BM); Kigezi, locally dominant in swamp, 2250 m alt., *Purseglove* 3737 (PRE); same locality, 1800 m alt., *Lind* 1A (BM); Kashambya Swamp, *Lind* s.n. (BM); Burbaria Swamp, *Lind* 2 (BM); Marius Bog, *Lind* 6 (BM); Lake Nabugabo, 'abundant in waterlogged cavities', *Wood* 1068 (BM); Papyrus swamp, *Eggeling* 794 (BM). KENYA: South Nyeri District, Aberdare Mountains, in boggy ground, *Townsend* 75/892. (BM). TANZANIA: Bukoba, *Stuhlmann* 1062 (BM, H, PC – type collections of *S. albicans*), 1690 (BM); '... M'pala am Westufer des Tanganjikasees', *Guillemé* 220 (H, as *S. pulchricoma* sensu Warnst.); Bukoba, 1120 m alt., *Haarer* 2083 (BM); *Geilinger* 537 (BM, mixed with *S. africanum*).

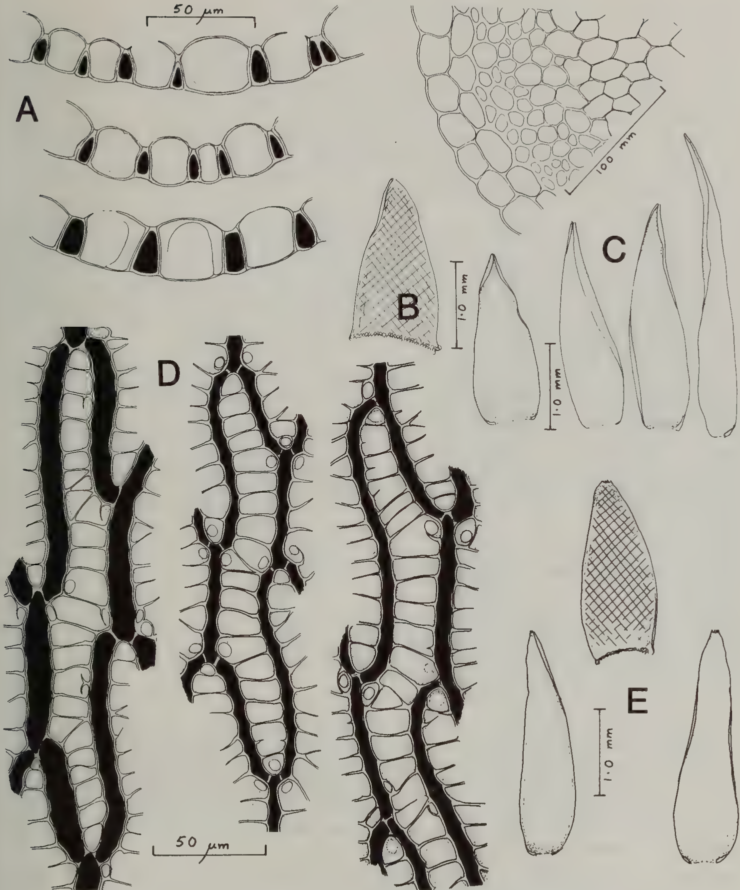

Fig. 41 *Sphagnum planifolium* C. Müll. var. *angustilimbatum* (Warnst.) A. Eddy. A, transverse sections of leaves; B, stem leaf; C, branch leaves; D, abaxial (left fig.) and adaxial (right figs) surfaces of branch leaves; E, stem leaf (upper fig.) and branch leaves (E drawn from the type of *S. congoanum*; the remainder from the type of *S. angusti-limbatum*).

East African Islands. MADAGASCAR: between Vinanintelo and Ikongo, *Besson* s.n. (PC – isotype of *S. bessonii*); Imerina, *Hildebrandt* s.n. (BM – type collection of *S. madegassum*, mixed with *S. tumidulum*); Ankazondandy, *Boiteau* 116 (PC); Tananarive, Mantasoa, in marsh, 1400 m alt., *Onraedt* 74.M.2105, 74.M.2108 (BM, with *S. pallidum*); Omalabe, north of Tananarive, 1300–1400 m alt., *Bosser* 12309 (BM, NAM).

17b. Sphagnum planifolium var. **angustilimbatum** (Warnst.) A. Eddy, **comb. nov.** (Fig. 41)

S. angusti-limbatum Warnst. in *Allg. bot. Z.* **1**: 135 (1895). – *S. albicans* Warnst. var. *angusti-limbatum* (Warnst.) Warnst., *Sphagnol. univ.*: 263 (1911). Type: 'Centralafrikan Seengebiet', *Stuhlmann* 3927 (H, herb. Brotherus).
S. stuhlmannii Warnst. in *Allg. bot. Z.* **1**: 172 (1895).
S. congoanum Warnst. in Ren. & Cardot in *Bull. Soc. r. bot. Belg.* **41** (1): 8 (1905). – *S. planifolium* var. *congoanum* (Warnst.) Warnst., *Sphagnol. univ.*: 223 (1911).
S. potieri Paul in *Revue bryol. lichén.* **4**: 72, fig. 7, pl. 2 (1931). Note: duplicates of the type collection, with the locality data 'Bukoba' (in Tanzania) are in BM.

Flaccid plants with the majority of branch leaves narrowly lanceolate to linear, with correspondingly narrow leucocysts (i.e. under 20 μm) and chlorocysts mainly exposed on both leaf surfaces. Such plants may almost lack dorsal pores and/or pseudopores, and the resemblance to *S. cuspidatum* is striking. Sometimes the only reliable character by which this taxon may be distinguished from *S. cuspidatum* is the non-expanded border of the stem leaf. Forms approaching this variety seem to be proportionately more frequent in the western than in the eastern parts of the range of the species.

West Africa. ZAIRE: Kisantu, 550 m alt., *Gillet* s.n. (PC); Kwango, *Jormain* 2695 (PC); Ndembo, Boko, *Vanderyst* s.n. (several gatherings, PC); 'Entre Dembo (sic) et Kisantu', *Gillet* 1535 (BM – type collection of *S. congoanum*).

Mlanje/Chimanimani. ZIMBABWE: Chimanimani, 1750 m alt., *Wild* 47953 (PRE), *Lacey* 33, 34, 35 (BM).

Ruwenzori/Usambara. UGANDA: Liebenburg (BM, no data). TANZANIA: Bukoba, *Stuhlmann* 3927 (BM, H – type collections of *S. angusti-limbatum*), *Stuhlmann* 4139 (BM).

East African Islands. MADAGASCAR: 'Forêt littorale Tampolo, Fenerive', *Guillaumet* 2365 (BM, NAM).

17c. Sphagnum planifolium var. **rugegense** (Warnst.) A. Eddy, **comb. nov.** (Figs 42 & 43).

S. rugegense Warnst. in Mildbr. in *Wiss. Ergebn. dt. ZentAfr. Exped.* **2**: 135 (1910). Syntypes: East Africa, Rugege, 1900 m alt., *Mildbraed* 817, 984 (B, destroyed, BM).
S. recurvatum Warnst. in Mildbr. in *Wiss. Ergebn. dt. ZentAfr. Exped.* **2**: 135 (1910).
? *S. ruwenzorense* Negri in *Annali Bot.* **7**: 161 (1908).
S. macromolluscum Dixon in *J. Bot., Lond.* **76**: 218 (1938).

Plants varying from rather small and compact to more or less robust but usually smaller and more compact than in var. *planifolium*, commonly tinged brown with pale brown stems. Stem leaves variable, mainly as in the type variety but shorter on average and less extensively fibrillose. Branch leaves all of the short form, ovate-lanceolate to broadly lanceolate. Hyaline cells of branch leaves typically with numerous small pores and/or pseudopores on the abaxial side; adaxial side with abundant, often almost seriate, rather small (4·0–7·0 μm), sometimes distinctly ringed pores.

Distribution. Forms of *S. planifolium* that can be assigned unequivocally to the variety *rugegense* are recorded only from high altitudes in the Ruwenzori/Usambara ranges. Scant field data indicate that the plants occur in open, flushed situations but not submerged. Plants having a morphology approaching typical *S. planifolium* are more widespread, extending further southwards in range, and also occurring in the East African islands.

Mlanje/Chimanimani. ZAMBIA: Mpika, swamp on mountain slope, 1725 m alt., *Van Zinderen Bakker* 973 (BM, PRE, intermediate form between var. *rugegense* and var. *planifolium*).

Ruwenzori/Usambara. RWANDA: Rugege, 1900 m alt., *Mildbraed* 817, 984 (BM – syntypes of *S. rugegense*). UGANDA: in bog on shore of Lake Nabugabo, 1150 m alt., *Eggeling* 571 (BM – holotype of *S. macromolluscum*). KENYA: Mount Kenya, 3000 m alt., *Mearns* 1727 (BM). TANZANIA: '. . . M'pala am Westufer des Tanganjikasees', *Guillemé* 220 (H).

Just as the number of synonyms (above) reflects to some degree the variability of *S. planifolium*,

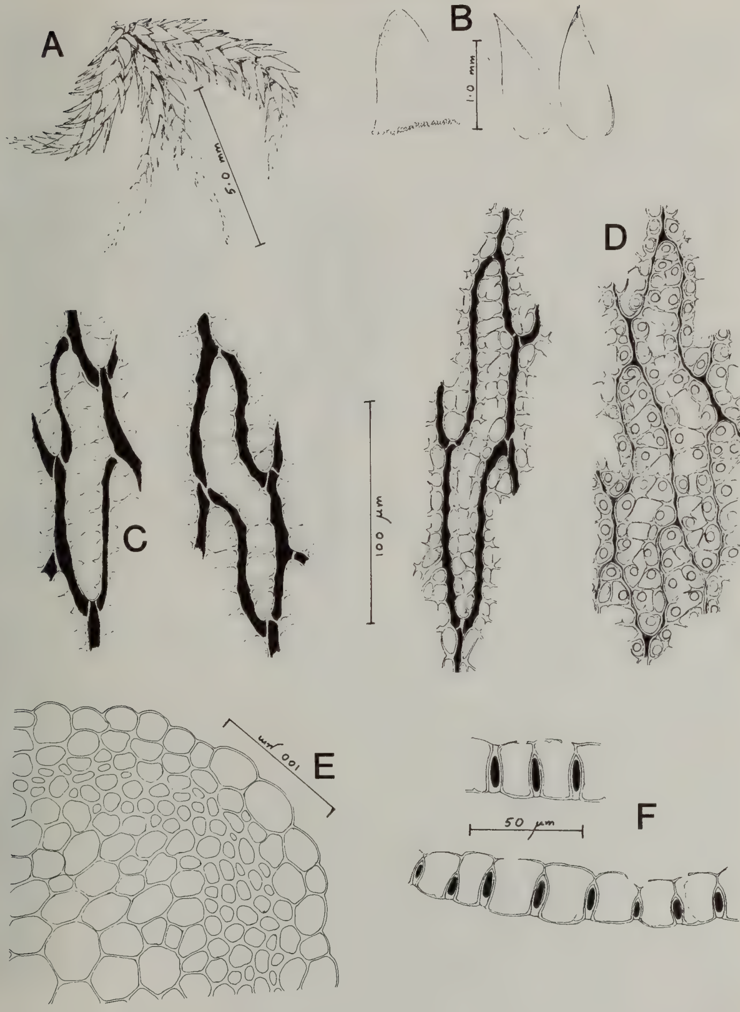

Fig. 42 *Sphagnum planifolium* C. Müll. var. *rugegense* (Warnst.) A. Eddy. A, branch fascicle; B, stem leaf (left) and branch leaves (right); C, abaxial (left) and adaxial (right) surfaces of stem leaf near leaf apex; D, abaxial (left) and adaxial (right) surfaces of branch leaf; E, transverse section of stem; F, transverse sections of branch leaf (all drawn from *Mildbraed* 817).

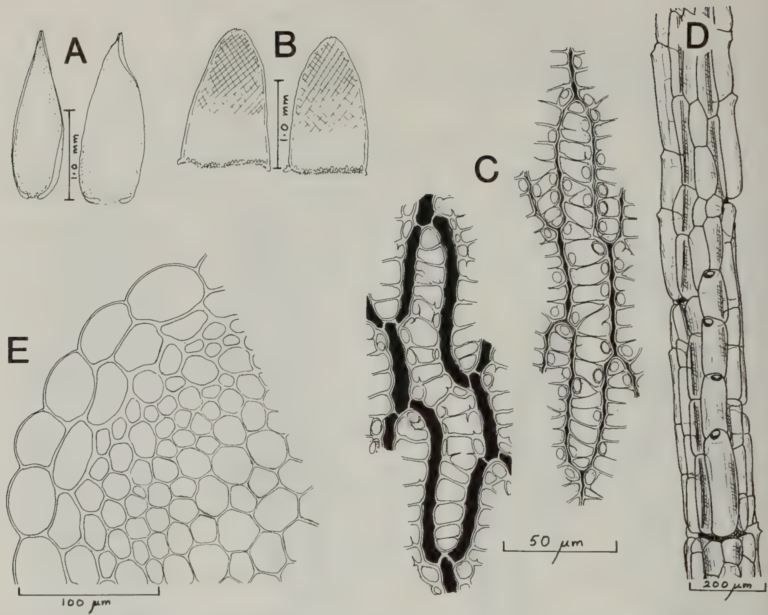

Fig. 43 *Sphagnum planifolium* C. Müll. var. *rugegense* (Warnst.) A. Eddy. A, branch leaves; B, stem leaves; C, abaxial (left) and adaxial (right) surfaces of branch leaves; D, branch cortex; E, transverse section of stem (all drawn from the holotype of *S. macromolluscum*).

so the changes in status of many, particularly in Warnstorf's treatments, indicate the difficulties encountered when trying to interpret the taxonomic value of the various expressions of the species. At one extreme, plants are broad-leaved, with a facies similar to the most robust forms of the European *S. riparium* Aongstr.; at the other extreme we have flaccid, weak, narrow-leaved plants superficially almost identical to *S. cuspidatum*. In relation to *S. planifolium* the situation is clearly comparable to that pertaining to *S. auriculatum* in Europe, and the equally polymorphic *S. truncatum* Hornsch. in Africa. The indeterminate genetic heterogeneity, which is to be expected in a taxon that occurs in widely scattered localities, is so confused with ecotypical plasticity that, at present, it is almost impossible to extricate significant and stable variants from the matrix of forms within the species. Presenting the synonymy of *S. planifolium* under separate varietal names implies a confidence not wholeheartedly possessed by the author.

The suppression of useful diagnostic characters by immersion, reduced light intensity, and other factors is well known in *Sphagnum*, and the associated elongation of leaves, reduction of pores, and tendency towards isophylly are familiar phenomena among European taxa. Conversely, exposure under conditions of high insolation tends to produce the opposite effects. It is quite possible therefore that the varieties (above) of *S. planifolium* are produced predominantly by ecological pressures and it would be instructive to determine to what degree their essential characters are reversible.

In addition to the varieties of *S. planifolium* described above, there are plants which superficially resemble *S. cuspidatulum* or *S. recurvum* P. Beauv., in that the branch leaves

are smaller than average, uniform in size, and 5-ranked. In many of these plants such resemblance is further enhanced by the tendency for the leaves to become recurved in the dry condition. There are, however, no anatomical features to suggest that such forms are anything more than local expressions of the species or of its variety *augustilimbatum*. *S. slooveri* (below) shares some of the superficial characters mentioned above, but is readily distinguished by its reflexed truncate-fimbriate, almost efibrose stem leaves.

S. planifolium is clearly an archaic taxon in the sense that it possesses a number of features that can be construed as primitive. Branch-leaf structure in unremarkable, being fairly average for section *Cuspidata* while at the same time showing the kind of flexible response to environmental conditions that seems to be particularly marked in 'primitive' taxa rather than those whose derived characters are more fixed. The stem leaves are unequivocally primitive, both in the isoareolate nature of their upper tissues and in the unexpanded border. Relationships between *S. planifolium* and other species of the section are unclear, although within the matrix of forms that constitute the species (as interpreted in this work) there can be detected tendencies towards more advanced forms (e.g. *S. recurvum* P. Beauv.), and *S. planifolium* var. *rugegense* has been compared with *S. mendocinum* Sulliv. (Warnstorf, 1910); at the other end of the scale, *S. planifolium* var. *angustilimbatum* is morphologically very close to the Malaysian *S. cuspidatum* subsp. *subrecurvum* (Warnst.) A. Eddy and, perhaps, to the austral species, *S. falcatulum* Bescher.

18. Sphagnum slooveri A. Eddy, **sp. nov.**
(Fig. 44)

Plantae aliquantum parvae, compactae, flavidae. Epidermis caulina stratis 2(–3), a cylindro crasso pallido plerumque plane distincta. Fasciculi ramorum 4–5 compositi; rami non diversi. Epidermis tamen eorum diversa; cellulae perforatae plerumque binatim in longitudinem dispositae, non rostratae. Folia caulina deflexa, triangulata, circa 1·0 mm longa, basi 0·9 mm lata, apicibus late truncatis, circa 0·3 mm latis, eroso-fimbriatis; limbus superne 3–5 cellulas latus, deorsum distincte dilatatus; cellulae hyalinae in apicibus fibrosae et interiore superficie poris magnis obsitae; ceterae efibrosae pauciporosae vel eporosae. Folia ramorum dense imbricata, semper quinquefaria, uniformia, lanceolata, circa 1·3–1·4 mm longa, 0·5 mm lata, apicibus angustis, 3–4 dentatis, involutis, ut videtur acutis vel mucronatis; limbus angustissimus, 1–2 cellulas latus. Cellulae hyalinae ad 20·0 μm latae, 100–140 μm longae, exteriore superficie eporosae vel poris singulis in angulis apicalibus obsitae sed pseudoporis multis saepe seriatis ad commissuras instructae; interiore superficie multiporosae, poris minutis plerumque incrassato-marginatis, 2·0–4·0 μm diametro, prope commissurae nec confinibus dispositis. Cellulae chlorophyllosae sectione transversali triangulae in interiore folii superficie inclusae (cellulae hyalinae ubi se contingunt parietibus coalitis).

Typus: Africa, Burundi, 'tourbière d'Ijenda, 1950 m alt., sur le sol tourbeux', *Jean Louis De Sloover* 19.181 (BM – holotypus; NAM – isotypus).

Plants small to medium-sized, rather dense, resembling compact forms of *S. cuspidatulum*, yellowish. *Stems* relatively thick, about 0·9 mm diameter, pale yellowish to brownish yellow; cortical cells in mainly 2 layers, relatively distinct, imperforate; internal cylinder pale. *Fascicles* rather closely set, composed of (4–)5 branches which are rather short, up to 10·0 mm long; pendent branches not distinguishable. *Branch cortex* dimorphic but not conspicuously so; retort cells mainly in linear pairs, relatively short and scarcely rostrate; walls of all epidermal cells relatively firm. *Stem leaves* reflexed, about 1·0 mm long and about 0·9 mm across the insertion, triangular to triangular-lingulate, narrowed from the insertion to broad, more or less truncate, distinctly fimbriate apices about 300 μm across; fibrillose only in a small zone just below apex; border strong, distinctly widened in the lower half. Adaxial surface of fibrillose leucocysts with large, circular or irregular resorption gaps on the adaxial side; abaxial side mainly imperforate. *Branch leaves* rather small, regular in size and arrangement and closely and regularly quinquefarious, lanceolate, 1·3–1·4 mm long, about 0·5 mm wide, involute above and tapering to narrow, tubular, 3–4-dentate tips (which appear to be acute under low magnification). Border narrow, 1–2 cells wide, without a resorption furrow. *Hyaline cells* of branch leaves rather uniform, 20·0 μm wide on average, 100–140 μm long; abaxial surface without or with only 1–2 pores (of which one is typically in the apical cell angle) but with abundant, often almost seriate

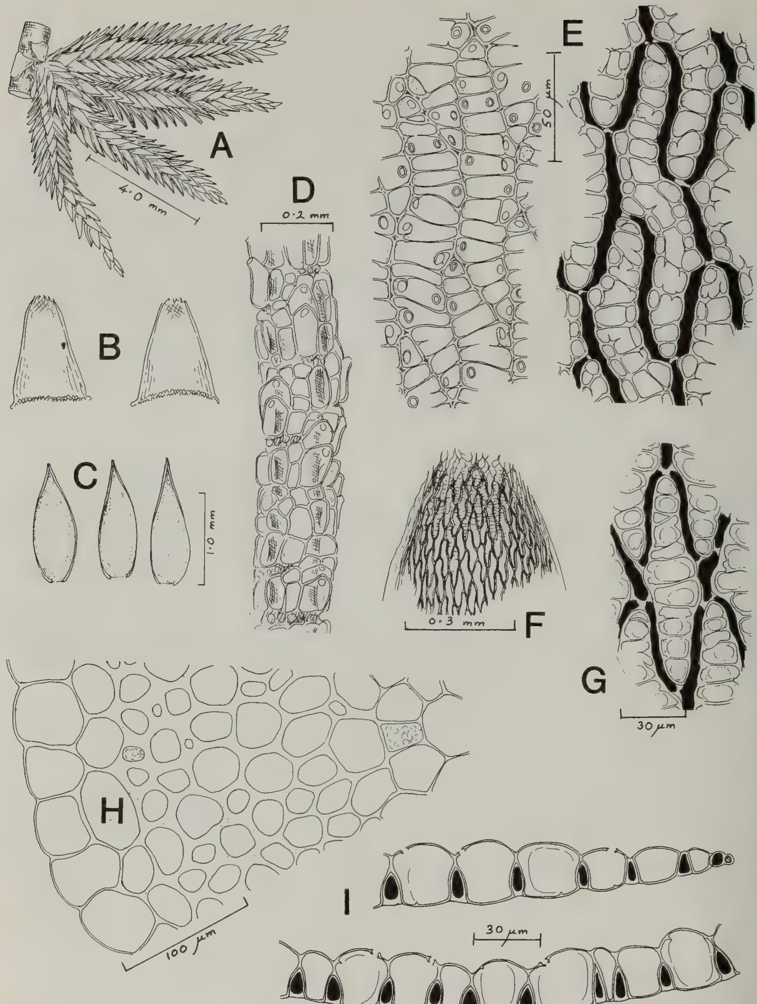

Fig. 44 *Sphagnum slooveri* A. Eddy. A, branch fascicle; B, stem leaves; C, branch leaves; D, branch cortex; E, adaxial (left) and abaxial (right) surfaces of branch leaf; F, apex of stem leaf; G, adaxial surface of fibrillose region of stem leaf; H, transverse section of stem; I, transverse sections of leaf (all drawn from the holotype).

pseudopores; adaxial surface with numerous, very small, unringed or frequently heavily ringed pores set at some distance from the commissures. *T.S. leaf*. Hyaline cells more or less plane on the abaxial side, shallowly convex on the adaxial side. Chlorocysts in section oval-triangular, broadly exposed on the abaxial side but rather deeply immersed below the adaxial side. Dioecious? Only the female, but unfertilized plant present in the type collection.

Distribution. At present known only from the type locality, in boggy ground.

Ruwenzori/ Usambara. BURUNDI: 'tourbière d'Ijenda', 1950 m alt., *De Sloover* 19.181 (BM – holotype, NAM – isotypes).

This species clearly represents the end-point of an evolutionary line that connects it with *S. planifolium* via *S. planifolium* var. *rugegense*. At present, the discontinuity manifested in stem-leaf morphology and, to a lesser extent, the size and arrangement of the branch leaves has been deemed sufficient to support the recognition of *S. slooveri* as a species distinct from *S. planifolium* var. *rugegense*. This course also has the advantage of avoiding the addition of yet another infraspecific epithet to *S. planifolium* itself. Future collections, however, may reveal plants of intermediate character, at which time the whole position regarding *S. planifolium* and its allies may have to be reviewed.

The species is named in honour of Dr Jean Louis De Sloover, whose numerous collections of *Sphagnum* from eastern Africa and other regions have been made available for study by the author, and have helped to solve many of the systematic problems of the genus in Africa.

19. Sphagnum cuspidatulum C. Müll.
(Fig. 45)

in *Linnaea* **38**: 549 (1874). Type: India, Khasia, *J. D. Hooker & T. Thomson* 1284 (BM – isotype).

Plants elongate, of regular appearance with well marked capitula, pure green to yellow-green. *Fascicles* uniform in appearance and regularly disposed along stems, composed of (4–)5 branches which are distinctly dimorphic: 2–3 spreading branches elongate, (12·0–)15·0–25·0 mm long, relatively narrow and multifoliate (more than 80 fully developed leaves per branch); 2–3 pendent branches more or less appressed to stems, of variable length, up to 30·0 mm. *Stem* rather strong and rigid, 0·7–0·9(–1·1) mm diameter; cortex more or less distinct but tending to intergrade with the internal cylinder, in 2–3 layers of only moderately enlarged leucocysts, never with pores in the exposed wall and often somewhat incrassate; internal cylinder yellowish, rarely pale brown. *Branch cortex* dimorphic; retort cells distinct, in linear pairs, sometimes slightly protuberant at apertures. *Stem leaves* lingulate or more or less trapezoid, reflexed, 1·2–1·5 mm long, 0·7–0·9 mm wide at insertion; apices rounded to broadly truncate and conspicuously erose-fimbriate across the whole apical region; border evanescent above, slightly to moderately expanded below but rarely very conspicuously so. Leucocysts narrow at mid leaf and below, expanded and broadly rhomboid in apical region and largely resorbed; septa numerous. *Branch leaves* uniform in size and attitude, very numerous (more than 80 per branch), strictly 5-ranked; leaves lanceolate, apical parts sub-tubular with strongly incurved margins, 1·4–1·8 mm long, 0·7–0·8 mm wide, truncate-dentate; border 1–2 cells wide, without resorption furrows. Pendent-branch leaves mainly ovate-lanceolate, concave, 0·9–1·4 mm (longer and narrower on distal, tapering parts of branches). *Leucocysts* in apical leaf area narrow, especially on abaxial side, 11·0–18·0 × 70–120 μm on abaxial side, 13·0–20·0 μm wide adaxially in upper mid leaf, up to 30·0 μm wide in basal-lateral area of leaf; abaxial surface usually without normal pores but commonly with a few rather small pseudopores about the lateral angles and frequently with an inconspicuous resorption gap in the apical angle; adaxial surface with 3–6 medium-sized, circular, unringed or faintly ringed pores, *c.* 6·0–10·0 μm diameter, mainly adjacent to the cell angles (these pores often very faint and only visible after staining). Leucocysts of pendent-branch leaves not significantly different from those of spreading branches anatomically. *T.S. leaf*. Leucocysts more or less plane to shallowly convex abaxially, strongly convex adaxially. Chlorocysts isosceles-triangular, with rather wide (3·0–6·0 μm) exposure on abaxial side, mainly

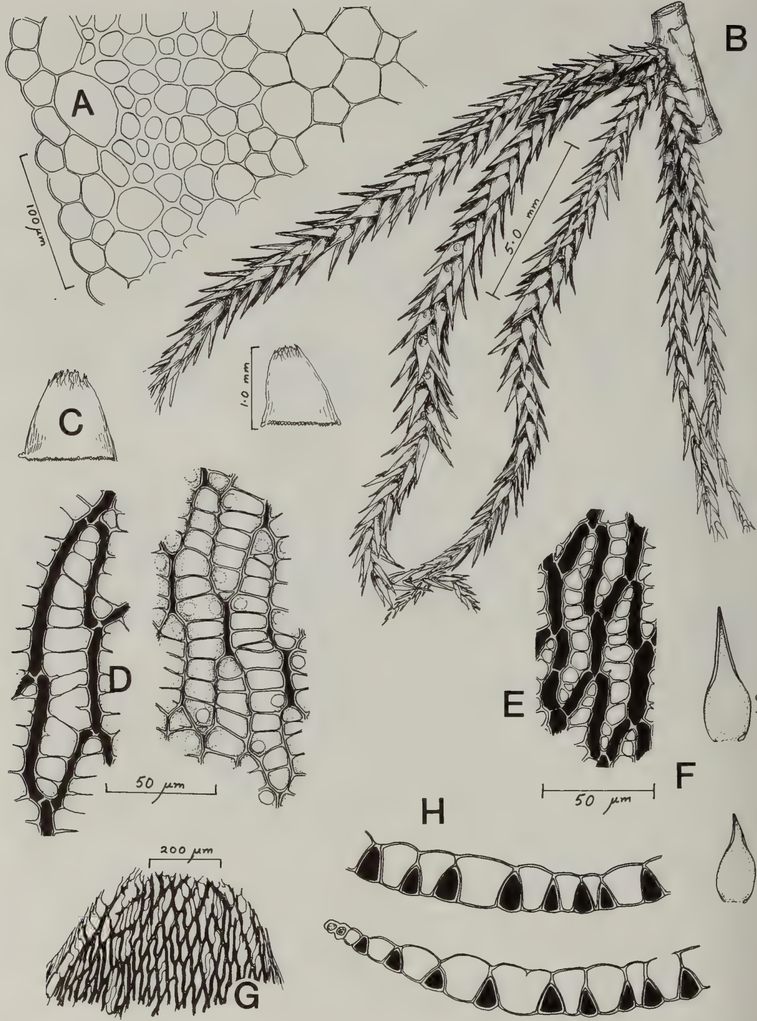

Fig. 45 *Sphagnum cuspidatulum* C. Müll. A, transverse section of stem; B, branch fascicle (with male branch); C, stem leaves; D, abaxial (left) and adaxial (right) surfaces of branch leaf; E, abaxial surface of apical region of branch leaf; F, branch leaves; G, apex of stem leaf; H, transverse sections of branch leaf (all drawn from *Bosser* 13076).

rather deeply immersed adaxially. *Dioecious*. Male branches more or less identical to sterile branches (at least in African material). Female plants unknown and fruit unrecorded.

Distribution. A terrestrial species of tropical oceanic regions, widespread in Indo–Malaya from western New Guinea to the Himalaya. In Africa known only from single localities in Madagascar and Rwanda. Possibly this, or a very closely related taxon, also occurs in tropical America (as *S. pulchricoma* P. Beauv. ?).

RWANDA: Bysoke, 3600 m alt., *De Sloover* 13441 (NAM).

MADAGASCAR: Niagarakety, Mt. Moramanga, *Bosser* 13076 (PC).

This is a well defined species which has no close relative among the other African taxa of section *Cuspidata*. Small-leaved states of *S. planifolium* have very different, never completely efibrose, stem leaves. In fact, the stem leaves of *S. cuspidatulum*, as far as African species are concerned, are more reminiscent of those of *S. fimbriatum*.

There is a reference to a putative African mainland specimen of *S. pulchricoma* P. Beauv. (Warnstorf, 1911: 189) but no trace of the species could be traced in the herbarium cited (Brotherus). Probably this record is in error. However, the similarities between *S. pulchricoma*, as presently and probably imperfectly understood by the author, and *S. cuspidatulum* are very close, so much so that it may prove impracticable to maintain them as separate taxa in future. The discovery of an unequivocal specimen of *S. cuspidatulum* among unidentified material from Madagascar raised the possibility that this taxon could occur in East Africa and that it might be the plant to which Warnstorf referred.

Surprising though it may seem, that such a characteristic and by no means inconspicuous species has never been recorded before or since the collection made of it by Bosser in 1959, there is no reason to doubt the provenance of the specimen cited above. The more recent collection by De Sloover in Rwanda extends the African range of the species considerably, and indicates a more widespread occurrence in former times.

Subgenus ***RIGIDA***

Sphagnum subgen. ***Rigida*** (Lindb.) A. Eddy in *Bull. Br. Mus. nat. Hist.* (Bot.) **5** (7): 431 (1977).
Sphagnum 4. *Rigida* (Lindb.) Schlieph. in *Verh. zool.-bot. Ges. Wien* **15**: 413 (1865), excl. parte. – Lindb., *Musci scand.*: 11 (1879). Type: *Sphagnum rigidum* (Nees & Hornsch.) Schimper = *S. compactum* DC.

Plants large-leaved and normally robust, typically brownish or straw-coloured. Stem hyaloderm well developed, 2–4-layered and foraminate. Branch hyaloderm not dimorphic, all or the majority of leucocysts slightly to strongly protuberant and with a large pore. Branch fascicles strongly dimorphic. Stem leaves small, often more or less vestigial. Branch leaves very large, often exceeding 2·5 mm, commonly squarrose. Branch-leaf leucocysts uniform, rather short and wide, not highly inflated; adaxial face pauciporose but always with pseudolacunae at the conjunction of the basal and lateral convergence of three adjacent leucocysts; adaxial face typically with few to numerous ringed pores. Antheridia typically borne on pendent, not spreading branches.

This is a well defined, monosectional subgenus containing few species (probably only three in all) with many features pointing to an evolutionary history paralleling that of subgenus *Sphagnum*. The group is represented in Africa by a single taxon, *S. strictum* subsp. *pappeanum* which, although reaching its maximum diversity in that continent, is probably a relict from a formerly more widespread tropical and subtropical range that included Malaysia and central America.

20. Sphagnum strictum Sulliv. subsp. **pappeanum** (C. Müll.) A. Eddy (Figs 46 & 47)

in *Bull. Br. Mus. nat. Hist.* (Bot.) **5** (7): 433 (1977). – *S. pappeanum* C. Müll., *Syn. musc. frond.* **1**: 101 (1848). Type: Cape of Good Hope near Zwellendam, *Pappe* s.n., 1838 (BM, H).
S. lacteolum Bescher. in *C. r. hebd. Séanc. Acad. Sci., Paris* **81**: 725 (1875).
S. patens Bescher. in *Ann. Sci. nat.* (Bot.) VI, **10**: 329 (1880), *hom. illeg.*, non *S. patens* Brid. (1806).

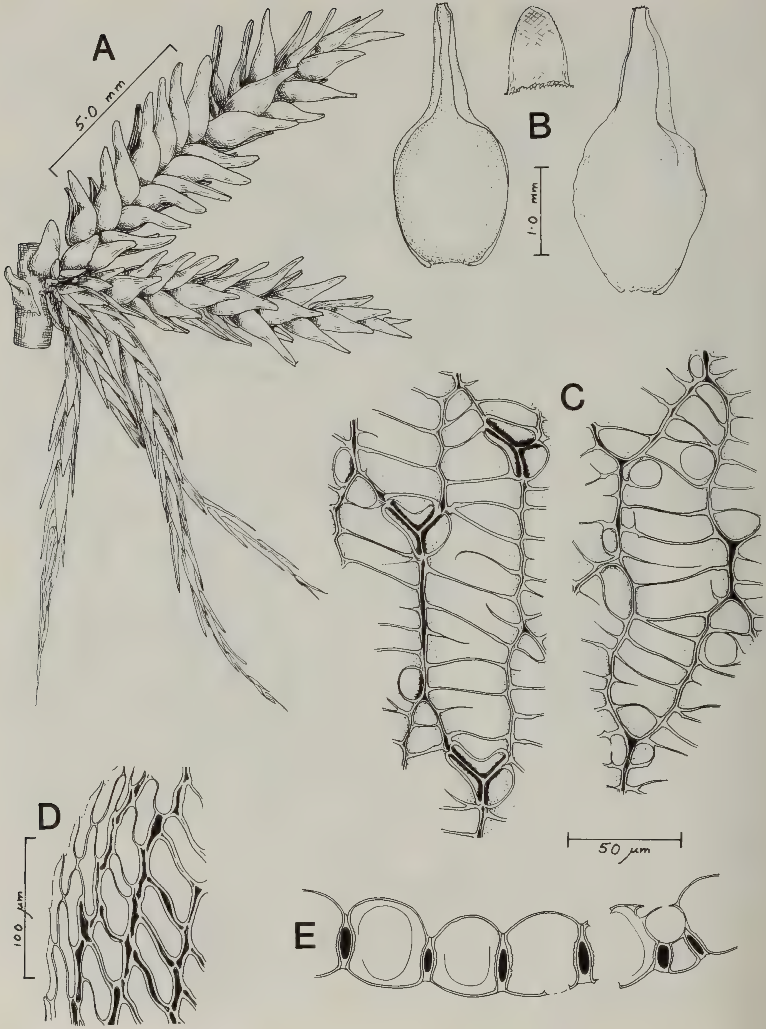

Fig. 46 *Sphagnum strictum* Sulliv. subsp. *pappeanum* (C. Müll.) A. Eddy. A, branch fascicle; B, stem leaf (centre) and branch leaves; C, adaxial (left) and abaxial (right) surfaces of branch leaf; D, upper margin of stem leaf; E, transverse section of branch leaf (all drawn from *Rehmann* 12).

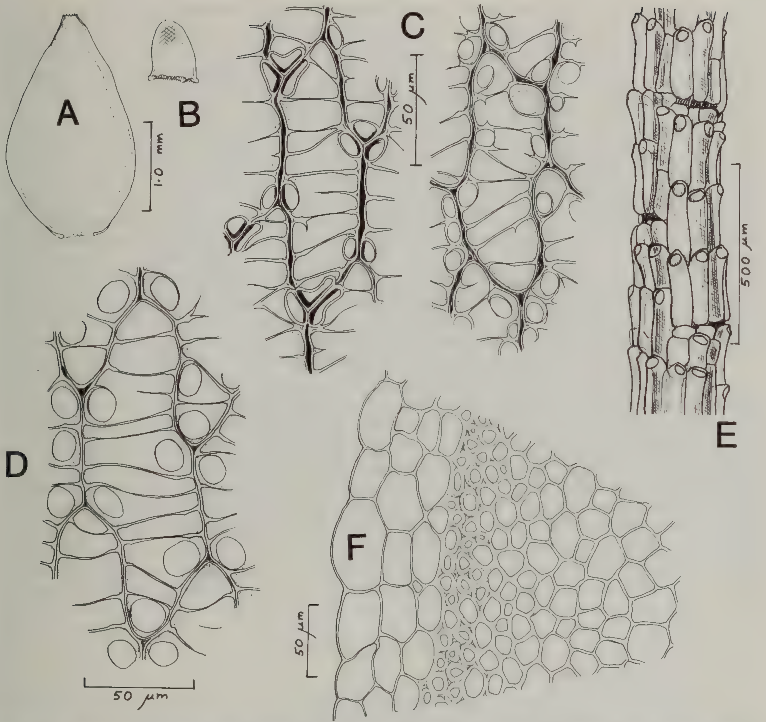

Fig. 47 *Sphagnum strictum* Sulliv. subsp. *pappeanum* (C. Müll.) A. Eddy. A, branch leaf; B, stem leaf; C, adaxial (left) and abaxial (right) surfaces of branch leaf; D, abaxial leaf surface, lower lateral leaf region; E, branch cortex; F, transverse section of stem (all drawn from the type collection of *S. mildbraedii*).

S. bescherellei Warnst. in *Hedwigia* **29**: 240, tab. 11 fig. 12, tab. 14 fig. g (1890).
S. sparsifolium Warnst. in *Hedwigia* **33**: 320 (1894). – *S. pappeanum* var. *sparsifolium* (Warnst.) Warnst., *Sphagnol. univ.*: 151 (1911).
S. mildbraedii Warnst. in *Wiss. Ergebn. dt. ZentAfr. Exped.* **2**: 134 (1910).

Plants very variable in stature, short and compact to elongate and very robust, pale yellowish or greenish varying to pale brown. Capitula sometimes concealed among upwardly directed sub-comal branches. *Fascicles* closely packed or spaced at short intervals on stems, internodes concealed by pendent branches, always very markedly dimorphic: spreading branches usually 2, horizontal or ascending, ending abruptly or more or less suddenly contracted distally and tapering, (15·0–)20·0–30·0(–40·0) mm long; pendent branches 2–4, strongly deflexed, pale, thin and tapering, very variable in length from vestigial up to more than 40 mm. *Stems* pale, yellowish to yellow-brown, 0·7–1·0 mm diameter; cortex well developed, composed of (2–)3–4 layers of hyaline cells, the outermost cells variable in diameter but most having a single large pore in the external wall; internal cylinder well developed but cells less incrassate than in other sphagna of

comparable vigour, yellowish to pale brown. *Branch cortex* monomorphic, composed of large leucocysts, several or all of which have a large pore. *Stem leaves*, for the size of the plant, very small, (0·7–)0·9–1·2(–1·45) mm long, *c.* 0·6–0·9 mm across insertion, triangular-ovate with rounded, more or less eroded apices; border not, or only very slightly and indistinctly expanded below; tissue normally fibrillose below apex, rarely to much beyond two-thirds, very occasionally completely devoid of fibrils; leucocysts more or less eporose on abaxial surface but with resorption gaps on the adaxial side. *Branch leaves* very large, (2·0–)2·5–4·0 mm long, more or less ovate to ovate-lanceolate but usually appearing to be abruptly contracted at about the middle to a narrower, sub-tubular spreading to sub-squarrose limb, widest at about 1/4 to 1/3 above insertion (*c.* 1.5–2·5 mm); apices broad, truncate and strongly 7–10-dentate; border narrow, of a single cell series, with a resorption furrow. Pendent-branch leaves delicate, the lower more or less ovate, becoming narrowly lanceolate distally, often lacking a defined border. *Leucocysts* usually very regular in size and arrangement in mid-leaf, broad, 30–40 μm wide, 90–150 μm long; abaxial surface very variable, typically with 1–4 rather large, thin-ringed pores adjacent to the upper and upper-lateral angles, pores *c.* 12·0–20·0 μm diameter, with or without pseudopores, seldom lacking pores altogether; adaxial surface always with pseudolacunae ('triple pores') at the confluence of basal and lateral angles of adjacent leucocysts, the external common apertures frequently very narrow and tri-radiate, with or without additional simple pores on the cell angles or elsewhere, with or without pseudopores. Leucocysts towards the lower lateral leaf areas becoming progressively more porose on both sides, pores sometimes becoming more or less serial. Hyaline cells of pendent-branch leaves all highly porose (resembling some species of section *Subsecunda*). Internal commissural walls occasionally smooth but usually distinctly to rather coarsely papillose. *T.S. leaf.* Leucocysts very shallowly convex abaxially, rather more inflated adaxially; partial septa (= fibrils) narrow. Chlorocysts narrow with narrowly oval lumina, rarely entirely enclosed on both sides of leaf but frequently so on the adaxial side; abaxial wall, at least, strongly thickened and narrowly exposed. *Autoecious*. Antheridia borne on pendent branches, the perigonial leaves scarcely distinct. Lowest perichaetial leaves approaching stem leaves in morphology but median and upper very large and strongly fibrillose; innermost bracts convolute, 4·5–6·5 mm long, elongate-cymbiform; uppermost tissue more or less identical to that of branch leaves; lowermost resembling that of stem leaves, lacking fibrils and with adaxial resorption-gaps. Fruit frequent (in favourable habitats); spores 32–35(–40) μm diameter, light brown, with very thick walls and varying from almost smooth to rather coarsely rugulose-papillose.

Distribution. Pan-tropical with wide disjunctions. Confined to regions of high oceanicity at high altitudes or on islands: Sulawesi, New Guinea, Central America and the West Indies, Africa and the East African islands. In Africa its main occurrence is in Cape Province in the south, the Ruwenzori Range in the east, and on Réunion and Madagascar in the Indian Ocean.

Southern Africa. CAPE PROVINCE: 'Prom. bon. spei prope Zwellendam', *Pappe* s.n. (BM, H – type collections of *S. pappeanum*); Montagu Pass, *Rehmann* exs. 12 (H); *McOwan* s.n. (PRE). TRANSVAAL: Marieskop, *Schyff* 5647 (PRE); Marieskop Summit, *Vorster* 1061 (PRE).

Ruwenzori/Usambara. ZAIRE: Karisimbi volcano, moor at 3400 m alt., *Mildbraed* 2074 (BM – type collection of *S. mildbraedii*); same locality, *Humbert* 7841, 7842, 7843, 7845 (PC); river valley east of Bahungu, 3180 m alt., *Demaret* 5277 (H); Runssoro, 2800–3000 m alt., *Stuhlmann* 2385 (BM) (same gathering in H labelled 'Ru-Nssoro 3100 m alt.'); Kivu, several collections from 3000–3300 m alt., *De Sloover* 12788, 12789, 12799 (BM, NAM), *Troupin* 2573 (BM). RWANDA: Bysoke, 3600 m alt., *De Sloover* 13442 (NAM); Gahinga, 3440 m alt., *De Sloover* 13541 (NAM); Birunga, Karisimbi, 3000–3900 m alt., *De Sloover* 13029, 13214 (NAM). UGANDA: Mgahinga Nigezi, in swamp in crater, 3300 m alt., *Thomas* 2446 (BM), *Lind* 13, 14 (BM); Toro District, Ruwenzori at 3500 m alt., *Osmaston* 3769 (BM); Ruwenzori, 5000 m alt [?], *Grinrod* s.n. (BM, no other data); Ruwenzori, 12000 ft [3500 m] alt., *Hancock* 113 (BM). TANZANIA: Lupanga, mist forest at 2000 m alt., *Lovett* s.n. (BM).

East African Islands. MADAGASCAR: Mt Tsaratanana, 2400 m alt., *P. de la Bathie* 16228 (PC, fertile); Mt Papanga, near Befotaka, on irrigated siliceous rocks, *Humbert* s.n. (PC). RÉUNION: *Lépervanche* 17 (BM, scraps in herb. Hampe; PC – type collection of *S. bescherellei*); Mafaté, *Rodriguez* s.n. (H); Forestry post of Bébour, edge of stream at 1600 m alt., *Onraedt* 69.R.0602 (BM); Cirque de Cilaos, 1950 m alt., *De Sloover* 17611, 17616 (NAM); Cirque de Cilaos, Coteau Kerreguen, 2250 m alt.,

Gimalac 70.R.3507 (BM, NAM). AMSTERDAM ISLAND: *G. de l'Isle* s.n. (PC – isotype of *S. lacteolum*).

Examination of the considerable number of available gatherings of this species has demonstrated that, in spite of considerable variation in size, there are no other morphological features upon which taxonomic subdivisions can be sensibly made. The variety *S. pappeanum* var. *sparsifolium* of Warnstorf is simply the more robust expression of the species from favoured habitats. *S. mildbraedii* Warnst. on the other hand, is a rather starved or repressed state which turns up from time to time among material from particularly high and exposed situations on Ruwenzori. In these the leaves are not obviously squarrose, the branch-leaf cells are narrower, and the pores are sometimes more numerous and smaller. However, intermediate forms are not rare, and even within a gathering the features tend to be inconstant, indicating that the genetic element in the variation is less significant than the ecological element.

There should be no problem in identifying this species, even at a casual glance. The sub-squarrose, large branch leaves, extremely dimorphic branches, and minute stem leaves is a combination of features not found in any other African taxon. Species of subgenus *Sphagnum*, even when they lack cortical fibrils, have cucullate, not truncate-dentate leaves and larger stem leaves. Occasional squarrose-leaved states of the larger-leaved members of section *Subsecunda*, e.g. *S. truncatum*, have large stem leaves, and monomorphic branches.

S. strictum appears to be a species that has rather narrowly circumscribed ecological requirements, demanding a pronouncedly oceanic environment and seemingly intolerant of sustained high or low temperatures. This applies equally or possibly even more strongly to *S. strictum* subsp. *pappeanum* than it does to subsp. *strictum*. In East Africa, *S. strictum* subsp. *pappeanum* occupies a rather narrow altitudinal zone, being more or less confined to 2500–3500 m alt., but descends to much lower altitudes on mountain ranges facing onshore winds in the East African islands and the Cape region of southern Africa. In common with the other species of subgenus *Rigida*, this taxon is intolerant of immersion and is therefore unable to extend its habitat range by adopting a semi-aquatic mode of existence. On the other hand, it is a monoecious and frequently fruiting plant, so that regeneration from spores may to some extent compensate for the barriers to survival imposed by its special needs.

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Accepted names are in roman and synonyms in *italic*; new names are in **bold**, as are principal references. An asterisk (*) denotes a figure.

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Studies in the genus *Hypericum* L. (Guttiferae)
3. Sections 1. *Campylosporus* to 6a. *Umbraculoides*

Norman K. B. Robson

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Contents

Synopsis

A systematic account is given of the 64 Old World shrubby species of *Hypericum* L. (sects 1–6). A new shrubby species from Mexico (*H. umbraculoides* N. Robson **sp. nov.**) is included which belongs to a new section (sect. 6a. *Umbraculoides* N. Robson **sect. nov.**) and is related to the Chinese *H. monogynum* L. A discussion of the morphology, chromosome numbers, and distribution of members of the sections concerned is incorporated.

In addition to the new section and species, the following new taxa are described: in sect. 1: *H. balfourii* (Socotra) and *H. socotranum* subsp. *smithii* (Socotra); in sect. 3: *H. cohaerens* (China: Guizhou), *H. subsessile* (China: Yunnan, Sichuan), *H. siamense* (Thailand), *H. lagarocladum* (China: south central), *H. addingtonii* (China: N.W. Yunnan), *H.* x *cyathiflorum* (*H. addingtonii* x *hookerianum*), *H. lacei* (E. Burma), *H. henryi* subsp. *hancockii* (China: Yunnan, Burma, Thailand, Sumatra), *H. maclarenii* (China: Sichuan), *H. bellum* subsp. *latisepalum* (China: W. Yunnan, N. Burma), *H. lancasteri* (China: N. Yunnan, S. Sichuan), *H. curvisepalum* (China: Yunnan, Sichuan, Guizhou), and *H.* x *dummeri* (*H. forrestii* x *calycinum*).

The following changes of rank (**stat. nov.**) are also made: *H. longistylum* subsp. *giraldii* (R. Keller) N. Robson, *H. henryi* subsp. *uraloides* (Rehder) N. Robson, *H. geminiflorum* subsp. *simplicistylum* (Hayata) N. Robson, *H. hircinum* subsp. *majus* (Aiton). N. Robson, and *H. hircinum* subsp. *albimontanum* (Greuter) N. Robson. In addition, *H.* x 'Hidcote' and *H.* x 'Eastleigh Gold' are recognised as hybrids, and *H. hookerianum* 'Rogersii' is treated as a cultivar, 'Charles Rogers'.

1. Introduction

Part 3* of this monograph of *Hypericum* L. begins the systematic account of the genus. It includes descriptions of 64 species in seven sections, i.e. sects 1–6 as treated in Part 1 and an additional, monotypic section, sect. 6a. *Umbraculoides*, which contains a new species with interesting phytogeographical relationships. It has also proved necessary to subdivide sect. 7. *Roscyna* and to divide sect. 9. *Hypericum* further. The new sections thus produced are indicated in Figs 4–6 as sects 7a and 8a but they will not be described formally until sects 7–9 sens. lat. are treated in a future part.

The species treated here therefore include those of (i) the basic (primitive) sect. 1. *Campylosporus* (Africa and adjacent islands), (ii) the closely related sect. 2. *Psorophytum* (Balearic Is.) and (iii) the immediately derived sect. 3. *Ascyreia* (south and east Asia and Pontic Turkey), along with its shrubby derivatives sects 4–6a (Taiwan and Luzon, Caucasus to Macaronesia, south Mexico). The other derivations of sect. *Ascyreia* are dwarf shrubs or wiry shrublets or herbs (sects 7–19).

Morphology

The species in sects 1–6a are thus all shrubs from *c.* 0·3 to *c.* 10 m in height. Except for some species in sect. 1, they entirely lack dark glands; but *H. xylosteifolium* (sect. 6) sometimes has yellowish glands fringing sepals and bracts. All have marginal punctiform glands, as well as laminar glands which are primitively linear but have become dissected and eventually punctiform. In addition, many species in sect. 3 have resinous punctiform glands on the lower surface of the leaf (ventral glands); but these are variable in occurrence and distribution and thus less useful taxonomically than are the other types (see Robson (1981: 80–82)).

The dissection and shortening of the laminar glands is correlated with changes from parallel (basically dichotomous) to pinnate and open to closed secondary venation, as well as with increasingly densely reticulate tertiary venation (see Part 2: 76–80).

The inflorescence in sects 1–6 is almost always 1-flowered or dichasial to monochasial; only very exceptionally does the axillary flowering shoot comprise more than one node, making the inflorescence pseudo-dichotomous (Part 2: 85).

In these sections the perianth is normally pentamerous. The sepals are mostly erect in flower and fruit and the petals spreading to deflexed ('flowers stellate'); but in sect. 3 there are trends towards spreading to reflexed sepals and, in sects 3 and 4, to incurved petals ('flowers cyathiform'). The five stamen fascicles are always pentamerous and free, except in sect. 6a, where they are 'trimerous' (i.e. united 2 + 2 + 1) (Part 2: 100–102). Sects 2 and 3 differ from most species in sect. 1 in having petals and stamen fascicles that are deciduous after flowering. This character difference breaks down partially, however, in *H. quartinianum* and *H. synstylum*, in which the petals (and also the stamens in the former) are tardily deciduous and the styles are usually completely coherent, foreshadowing the deciduous petals and stamens and completely coherent styles in the related sect. 20. *Myriandra* (Figs 1, 3). In *H. balfourii* and *H. socotranum* too, the petals are completely deciduous and the stamen fascicles tardily so; but in these species the styles are only partially coherent and may even become free in fruit in *H. balfourii*, a combination of characters that foreshadows the deciduous petals and free styles of the primitive members of the related sect. 3 (Fig. 1). The petals and stamens are also deciduous in sect. 5, but in all other sections derived from sect. 3 they have become persistent again (Fig. 3).

The number of styles and ovary placentae is normally 5 in sects 1–4 and 3 in sects 5–6a, the styles being appressed and more or less coherent in sect. 1 and free in most of the other sections. In part of sect. 3, however, there is a reversal of this trend, whereby the styles have become almost united in *H. monogynum* and its relatives, *H. prattii* and *H. longistylum*; in sect. 4 they are completely united. This union, though persisting in fruit in these species, nevertheless is not at all 'fundamental'; in the other derivatives of *H. monogynum* (viz. *H. cohaerens* (sect. 3) and sects 6 and 6a, as well as the herbaceous species, in sects 8–9a) the styles have become almost or completely free again.

* For part 1 see Robson (1977*a*); for part 2 see Robson (1981).

The ovary and capsule vary from ovoid-pyramidal to globose, and vittae are visible only in *H. xylosteifolium* (sect. 6); the capsule, however, is unknown in *H. umbraculoides* (sect. 6a). In *H. reptans* (sect. 3), as well as *H. androsaemum* and *H.* x *inodorum* (sect. 5), the capsule wall becomes fleshy; only in *H. androsaemum* does the fleshiness persist until maturity. The seeds vary from linear-reticulate to linear-foveolate or rarely scalariform-reticulate and are often carinate or winged (laterally and sometimes apically).

Cytology

In the monotypic sect. 2, as well as in the only taxon counted so far in sect. 1 (*H. revolutum* subsp. *keniense*), the chromosome number is 2n = 24. This is thought to be the primitive number for the whole genus (Robson, 1981: 150). From this there are several descending series of diploid numbers, in two sections (13, 30) extending to 2n = 14, with numerous polyploids (tetraploid or rarely hexaploid or secondary polyploids) on most numbers (Fig. 1). The number 2n = 12 in one species of sect. 30 is anomalous (Robson, 1981: 166).

In sect. 3 these descending series extend from 2n = 24 to 20, 22 having been counted so far only in *H. oblongifolium* (Fig. 4). Tetraploids (2n = 48, 46, 44) also occur in that species, and the 2n = 42 in the closely related *H. monogynum* may be a continuation of a similar series. 2n = 20 is the most frequently recorded number in the section, and tetraploids based on it (2n = 40) occur in sects 5 and 6. Within sect. 3, however, 2n = 40 has been recorded only in *H. kouytchense*, which also yielded a count of 2n = 36. The occurrence of 2n = 38 and 36 in the closely related *H. beanii* and *H. forrestii* indicates that x = 9 in this group has arisen at the tetraploid level. The only other report of this basic number in sect. 3 is an isolated one approximately at the hexaploid level (*H. angustinii*), and counts for related species are necessary in order to interpret it. It seems likely, however, that x = 9 at the diploid level is attained only in derivatives of sect. 3 (Fig. 4).

Among hybrids in sect. 3, however, diploid, triploid and pentaploid (or approximately pentaploid) numbers have been counted. All are on the base x = 10, if one assumes that the report of n = 18 for *H.* x *moserianum* (Part 2: 152) was based on a misidentification.

The data on which the above analysis is based are all cited in Part 2: Table 7, except for the count of n = 23 for *H. oblongifolium* (Singhal, Gill & Bir, 1980). Subsequent efforts by Dr Gibby to add to the list of counts in sect. 3 have not yet succeeded, owing to the difficulty of producing satisfactory preparations.

Distribution

In Part 2 it was shown (i) how the species of the basic sect. 1 have their nearest relatives in a semi-circle of surrounding continents and islands (pp. 182–187, figs 60–61); and (ii) how this distribution is consistent with the Continental Drift hypothesis (pp. 208–216, fig. 73).

(a) Sects 1. Campylosporus and 2. Psorophytum

The suggested relationships of species in sect. 1 and their derivatives are shown in Fig. 1, and their distributions and those of the derivative sections are summarised in Fig. 2.* From these figures it can be seen that the most primitive taxa (1. *H. bequaertii* and 2a. *H. revolutum* subsp. *keniense*) are confined to the East African mountains, but that 3a. *H. lanceolatum* subsp. *angustifolium* (which is morphologically very similar to *H. revolutum* subsp. *keniense*) is widely disjunct in the island of Réunion. In an earlier publication (Robson, 1979) it was shown how *H. revolutum* and *H. lanceolatum* appear to have evolved parallel subspecies (Fig. 2(i), (ii)), 2b. *H.*

* These diagrams differ slightly from that in Part 2 (Robson, 1981: fig. 61). The relationships of *H. revolutum* subsp. *keniense* have been resolved cladistically (as far as possible), and sects 27. *Adenosepalum* and 28. *Elodes* have been moved from the *H. quartinianum* line (v) to the *H. roeperianum* one (vi) after their relationship to that species had become apparent (see p. 169). In these and similar diagrams, although no strict cladistic analysis has been attempted, the branching has been represented in a cladistic manner except where the characters of a taxon are apparently wholly advanced (apomorphic) in comparison with those of its relative. Such a taxon is shown as directly derived from its relative. This practice violates one of the Hennigian tenets (i.e. that the ancestral taxon is changed when the clade branches), but it may often be considered a more accurate representation of the true relationships.

revolutum subsp. *revolutum* being widespread in the mountains of tropical Africa and Arabia whereas 3b. *H. lanceolatum* subsp. *lanceolatum* is confined to Réunion and the Comoro Islands (Grande Comore). The relatively early separation of Madagascar and the Mascarene region from Africa must have isolated *H. lanceolatum*, so that it has given rise only to *H. madagascariense* (Madagascar) and sect. 26. *Humifusoideum*, the most primitive species of which is now in New Guinea but probably reached there via Australia (Robson, 1981: 208–209, fig. 73).

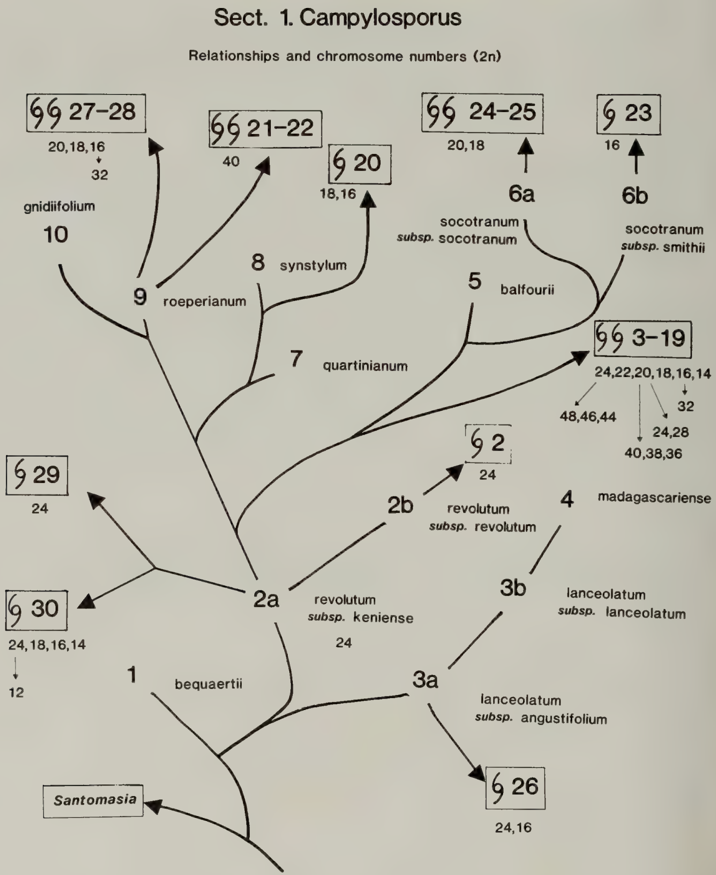


Fig. 1 Sect. 1. *Campylosporus*: Relationships and chromosome numbers (2n) of the 10 species, the other sections of *Hypericum* (in boxes) and the most closely related genus, *Santomasia*.

The remaining evolutionary lines in sect. 1 stem from *H. revolutum* subsp. *keniense*, and it does not seem possible to resolve them further cladistically, as each displays a different morphological advance from *H. revolutum* subsp. *keniense*. The line through subsp. *revolutum* (Fig. 2(i)), in which the inflorescence remains 1-flowered, shows a disjunction between north-east tropical Africa and the Balearic Islands, where sect. 2 *Psorophytum* (*H. balearicum*) is endemic. Another line (Fig. 2(iii)), which shows several correlated characters e.g. parietal

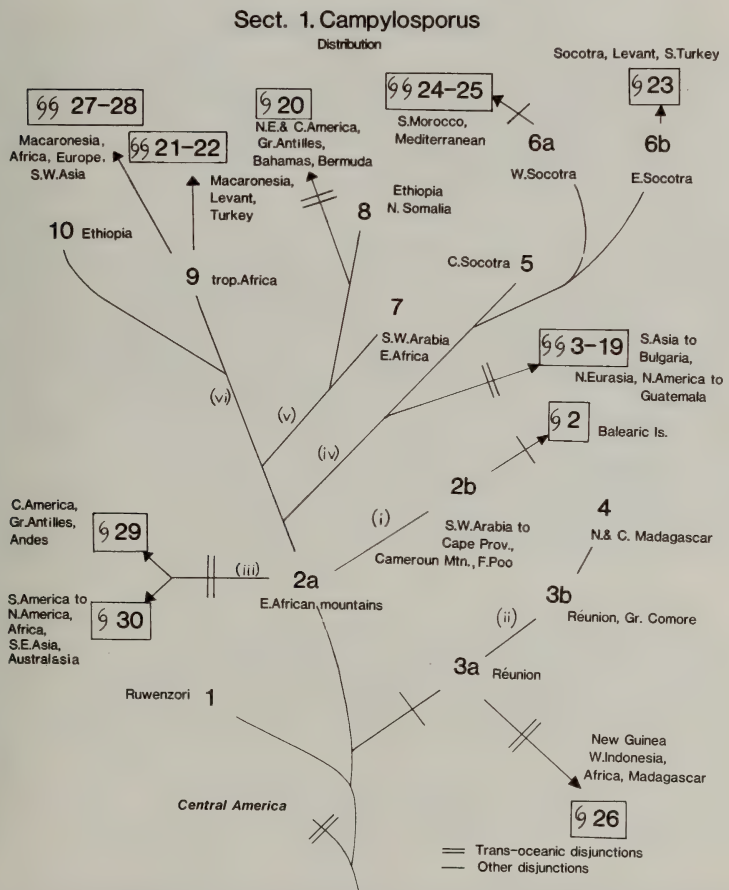


Fig. 2 Sect. 1. *Campylosporus*: Distribution of the 10 species, the other sections of *Hypericum* (in boxes) and the most closely related genus, *Santomasia* (Central America).

placentation and absence of dark glands, gives rise immediately to two trans-Atlantic disjunctions: sect. 29 *Brathys* with primitive species in northern S. America, Belize, and Cuba, and sect. 30. *Spachium* with primitive species in southern Brazil; the remaining line involves other species of sect. 1.

The eastern main branch of this line (Fig. 2(iv)) includes *H. mysurense* (sect. 3, in Sri Lanka and south India), which, as has been mentioned above, is morphologically close to *H. balfourii* of Socotra. These populations, along with *H. socotranum* (another Socotran endemic), have

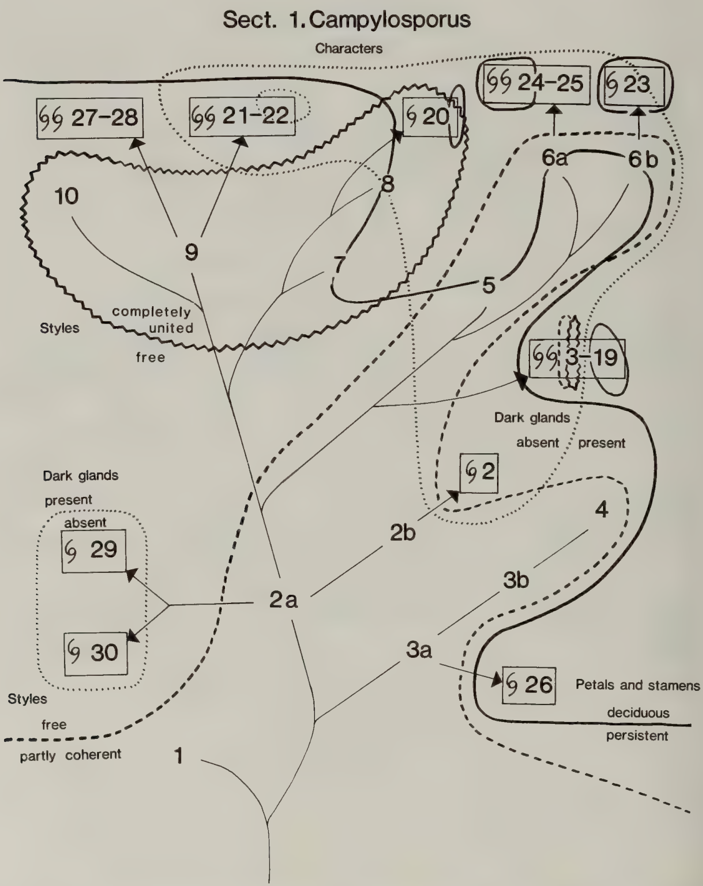


Fig. 3 Sect. 1. *Campylosporus*: Limits of certain characters within the section and in relation to the other sections. Note the progressions: styles partly coherent → free → completely united; petals and stamens persistent → deciduous → persistent; dark glands present → absent → present.

indeed usually been treated as conspecific (see p. 192); but even when separated, as they are here, they still represent a north-eastward disjunction that seems to be associated with the separation from Africa and north-eastward movement of the Indian subcontinent. Each subspecies of *H. socotranum* is related to a different section or sections, both containing low shrubby species with '3' stamen-fascicles and 3 styles. Subsp. *smithii* has its nearest relatives (belonging to sect. 23. *Triadenioides*) in Socotra, but other species in sect. 23 are in the Levant and south Turkey. Subsp. *socotranum*, on the other hand, has its nearest relatives belonging to sect. 25. *Adenotrias* in western Morocco, the more reduced or specialised forms and species of this section being scattered eastward through the Mediterranean to Syria.

The remaining western branch, which includes those species of sect. 1 that have retained at least some dark glands and have styles completely coherent or almost so, divides into two. In one of the sub-branches (Fig. 2(v)) the main lateral leaf veins are unbranched, the tertiary venation, if evident, is confined to areas between the midrib branches, and the pellucid glands are therefore mostly elongate (7. *H. quartinianum* and 8. *H. synstylum*). These species are confined to east and north-east tropical Africa and south-west Arabia; but they are closely related to sect. 20. *Myriandra*, centred in south-eastern N. America, in which the styles remain appressed but dark glands are absent and, as has been mentioned above, the petals and stamens are deciduous. In addition, in the more primitive species of this section the tertiary venation is conspicuously reticulate over the whole leaf.

The other sub-branch of the western branch (Fig. 2(vi)) includes species in which all the leaf venation has become conspicuously reticulate; the pellucid glands, in consequence, are mostly punctiform and are confined to the areoles of the reticulum (Part 2: 81, fig. 11d). Although the present distribution of the primitive species (9. *H. roeperianum*) extends farther west and south in tropical Africa than does that of species in branch (v), this species appears to have differentiated in the north-eastern part of tropical Africa. Three facts support this hypothesis: i) the most primitive form occurs there, ii) a variant that has sometimes been recognised as a separate species (*H. schimperi* Hochst. ex A. Rich.) or subspecies also occurs there, and iii) a closely related species that is advanced relative to *H. roeperianum* is nearly all characters (10. *H. gnidiifolium*) has a relict distribution in Ethiopia. *H. roeperianum* appears to have given rise to two distinct lines, one (sects 21. *Webbia* and 22. *Arthrophyllum*) related to '*H. schimperi*' and with a Macaronesia/E. Mediterranean distribution, the other (sects 27. *Adenosepalum* and 28. *Elodes*) related to the typical form and spreading from its Macaronesian 'centre' in three directions: i) northward to north-west Africa and western Europe, ii) eastward to north and east Africa and thence to the Himalayas and western Eurasia, and iii) southward to tropical and southern Africa. In both these lines the petals and stamens remain persistent but the styles become free and reduced to three (Fig. 3).

(b) Sect. 3. Ascyreia

It seems very reasonable to assume, from the morphological and distributional relationships of 1. *H. mysurense*, that its progenitors drifted north on the Indian subcontinent. This species is now confined to Sri Lanka and the southern mountains of India, apparently occurring as far north in the Western Ghats as Konkan in the Bombay region. Its leaves are concolorous but variably glaucous, and it gives rise to two lines (Fig. 5(A) and (B)), one initially with concolorous glaucous leaves (Spp. 2–11 and sects 7 and 9–19) and the other with green or discolorous leaves (Spp. 12–42 and sects 4–6a and 7a–8a).

Line (A) mostly comprises species that have relict distributions in the mountains on the north and east of the Indian subcontinent from Nepal eastward, with 6. *H. pachyphyllum* and 7. *H. augustinii* confined to small areas of central Burma and southern Yunnan respectively (branch (ii)). 5. *H. reptans*, although occurring along the Himalayan range from Nepal to north-western Yunnan, has its most primitive form in Burma and is absent from Bhutan, the country in which its closest relative, 4. *H. sherriffii*, is a localised endemic.

From this peripheral distribution alone, it is not clear whether these species spread and diversified before or after the initiation of the Himalayan orogeny; but consideration of the remaining two species of sect. 3 in this line provides a clue to this problem. 2. *H. cordifolium* and

3. *H. podocarpoides* are closely related local Nepalese endemics, both directly derivable from *H. mysurense* but not one from the other. Both appear to be ancestral to groups of sections that are centred on the other side of the Himalayan massif, *H. cordifolium* westward to Mediterranean/European sections radiating respectively from eastern Turkey (sects 17. *Hirtella* – 19. *Coridium*) and western Turkey (sect 10. *Olympia* – 16. *Crossophyllum*) (branch (i)) and *H. podocarpoides* northward to sect. 7. *Roscyna* (Altai Mts to Japan, eastern N. America) and its

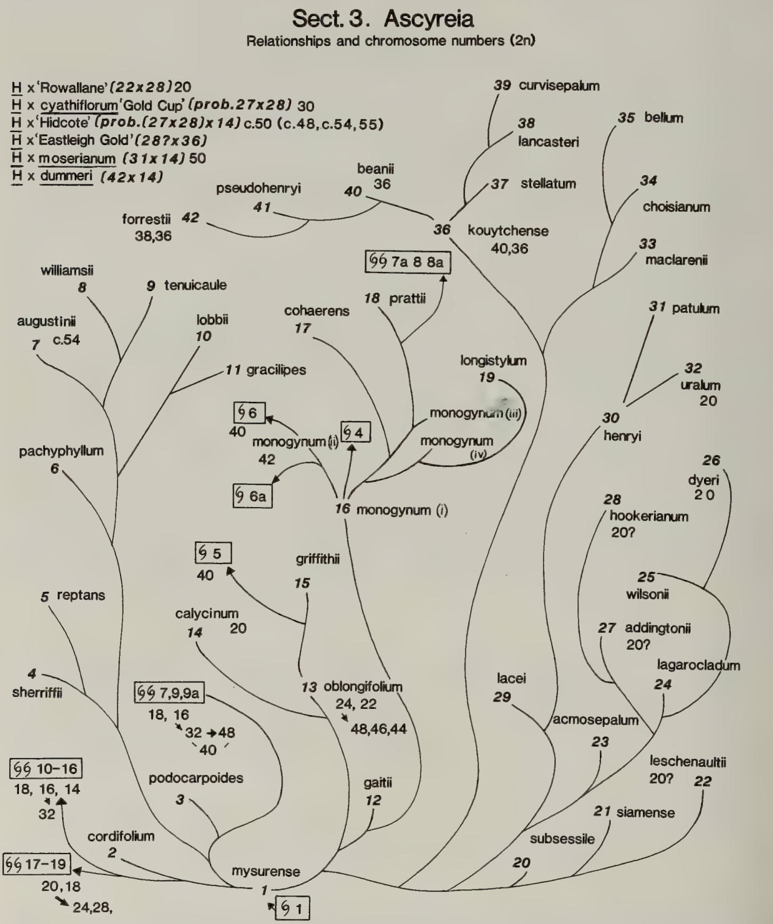


Fig. 4 Sect. 3. *Ascyreia*: Relationships and chromosome numbers (2n) of the 42 species and related sections, and a list of intrasectional hybrids, with parentage. See p. 325.

derivative sects 9. *Hypericum* and 9a. *Concinna* (north temperate zone) (branch (iii)). It would seem, therefore, that the Himalayan orogeny was instrumental in cutting off the ancestors of these sections from those of *H. cordifolium/podocarpoides*, which no doubt spread on to Eurasia after the Indian Plate had made contact with it. The species of line (ii) (4. *H. sherriffii* – 11. *H. gracilipes*), which are also derived from the *H. cordifolium/podocarpoides* affinity, can therefore be seen to be a third, eastward, development from that group. It probably achieved its initial

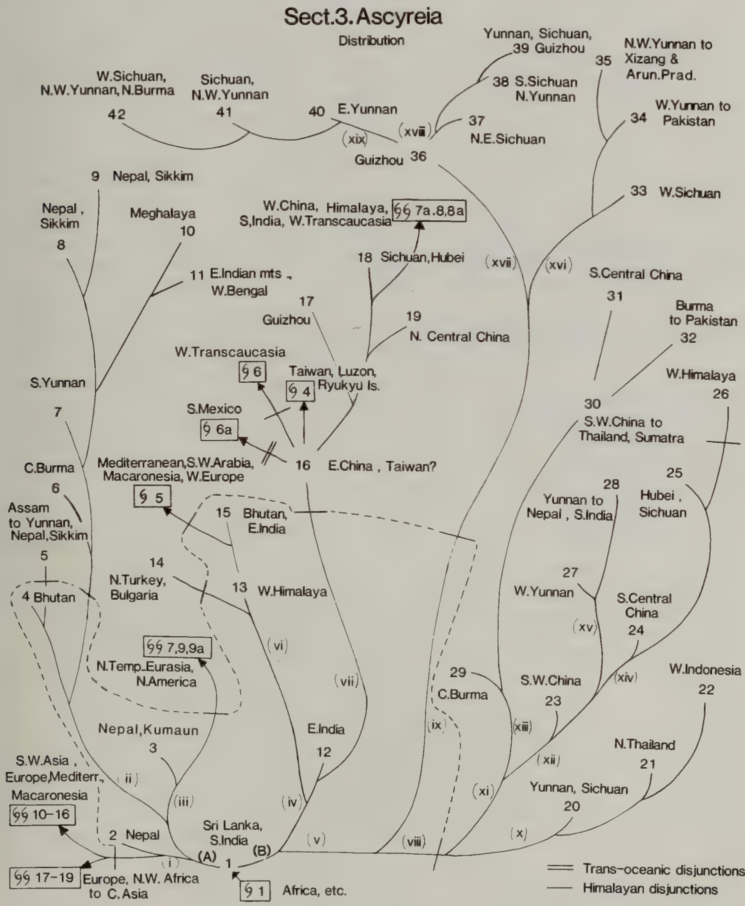


Fig. 5 Sect. 3. *Ascyreia*: Distribution of the 42 species and related sections. The single bars indicate trans-Himalayan disjunctions, the double bars trans-oceanic disjunctions, and the area enclosed by the broken line represents the original, cis-Himalayan distribution of the section. See also p. 325.

dispersal while the Himalayan range was relatively low; and its distribution would have been dissected as the mountains became more elevated. Thus the species from the highest altitudes (*H. reptans*) has the least dissected or relict distribution.

The other evolutionary line that stems from *H. mysurense* (Fig. 5(B)) has two main branches, of which one (iv) has a western sub-branch (vi) with Indian and Himalayan species (Spp. 12, 13,

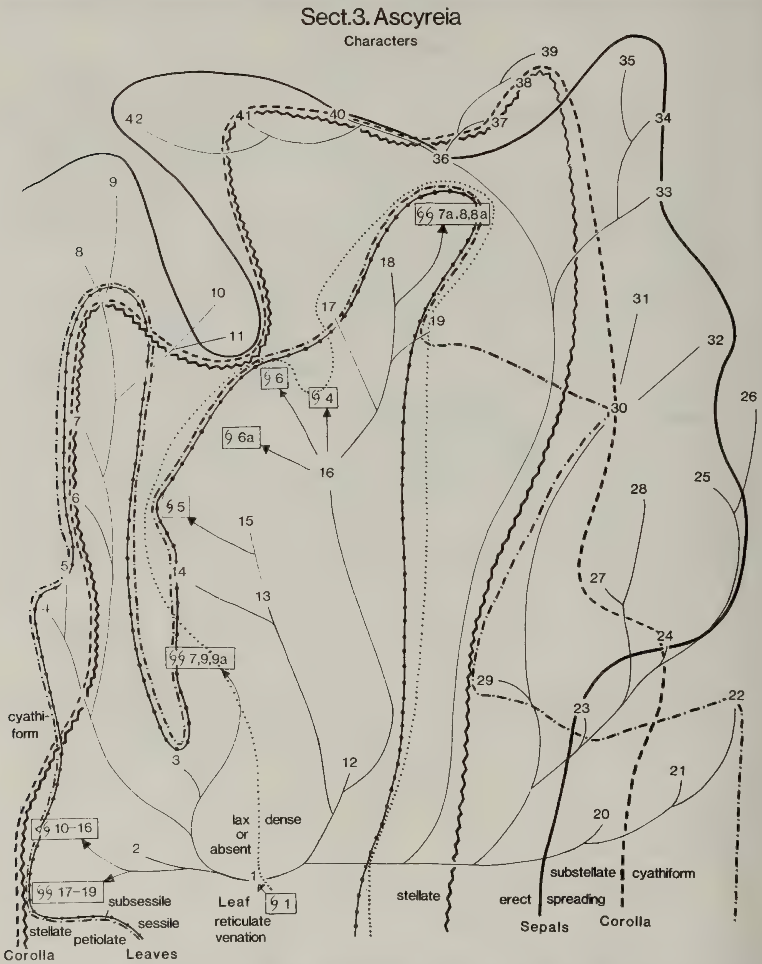


Fig. 6 Sect. 3. *Ascyreia*: Limits of certain characters within the section and in related sections. Note the progression: corolla stellate → subcyathiform → cyathiform. See also p. 325.

15) and then disjunctions to beyond the Himalayan Plateau (14. *H. calycinum* and sect. 5. *Androsaemum* westward to Turkey and the Mediterranean region). The eastern sub-branch (vii) has Spp. 16–19 in central China with derivative sections radiating from there, sect. 4. *Takasagoya* to Taiwan and Luzon, sects 7a and 8a (as yet unnamed) through China and south-east Asia to Pakistan, south India, and Thailand, sects 6. *Inodora* and 8. *Bupleuroides* to western Transcaucasia, and sect. 6a. *Umbraculoides* to southern Mexico. The occurrence of *H. xylosteifolium* (sect. 6) and *H. bupleuroides* (sect. 8) in Georgia and adjacent Turkey implies that *H. monogynum* had diversified (in China?) before the elevation of the Tibetan plateau.

In sub-branch (iv) the flowers are always stellate and the early species all have leaves with densely reticulate venation and free styles, the reticulation becoming less dense in 19. *H. longistylum* after the styles have become partially united (in 16. *H. monogynum*) (Fig. 6). As we have seen above (p. 164), this trend towards union becomes complete in sect. 4 *Takasagoya* but is reversed in 17. *H. cohaerens* and sects 6, 8 and 8a.

In the second main branch of the second line from *H. mysurense* (v), the leaves are green or discolorous (not uniformly glaucous) with at most laxly reticulate venation. The styles remain free, but the flowers evolve from stellate to cyathiform along several lineages (Fig. 6). The distribution of this group (Spp. 20–42) ranges from central China westward along the Himalaya to Pakistan, southward to south India (28. *H. hookerianum*), and through Indonesia to Lombok and western Sulawese (22. *H. leschenaultii*). Unlike the other lines that have been discussed, this one remains in sect. 3. It has two main branches, which are difficult to differentiate morphologically as whole branches, although the relationships of the individual species in each are clear enough.*

Lineage (v) as a whole is centred in south-west China (Yunnan, Sichuan, Guizhou) and, being directly related to *H. mysurense*, thus displays another trans-Himalayan disjunction in distribution.

The more northern sub-branch (ix) has a western division (xvi) (33. *H. maclarenii* – 35. *H. bellum*; Sichuan to north-western Yunnan, southern Xizang (Tibet) and along the Himalaya to Pakistan) and an eastern one (xvii) (36. *H. kouytchense* – 42. *H. forrestii*; Guizhou and Sichuan to northern Burma), the latter also dividing into a mainly north-eastern branch (xviii) (Spp. 37–39) and a mainly south-western one (xix) (Spp. 40–42) linked by 36. *H. kouytchense*. Spp. 36–39 stand out from the others in line (ix) by the combination of narrow acute spreading sepals and an acute petal apiculus; Spp. 33–35 have rather bluish-green leaves that are either rather thin and sub-bullate or undulate-margined, whereas in Spp. 40–42 they are mid-green and neither bullate nor undulate.

The more southern sub-branch (viii) also has two main divisions of which one (x) represents an early diversification southwards from Yunnan/Sichuan (20. *H. subsessile*) through Thailand (21. *H. siamense*) to western Indonesia (22. *H. leschenaultii*). It shows morphological trends from elliptic to overate or lanceolate leaves and ovate or broadly elliptic to narrowly elliptic or oblanceolate sepals. *H. leschenaultii* (x) has converged morphologically with 34. *H. choisianum* (xvi), which has evolved along a similar line except for the closed rather than open leaf venation (see p. 273).

Sub-branch (xi) comprises species that tend to have not only the leaves in one plane (a fairly common state in species with arching stems), but also the lateral branches. In one line (xiii), where the stems are mostly erect to arching, this results in a fern-like (frondose) habit (e.g. in 32. *H. uralum*); in the other (xii) the extreme species can be prostrate or pendulous (35. *H. wilsonii*, 26. *H. dyeri*). Here, again, the primary division of line (ix) is geographical, line (xii) starting to the north-east (23. *H. acmosepalum* in north-eastern Yunnan, Guizhou and Hunan) and line (xiii) to the south-west (29. *H. lacei,* 30a. *H. henryi* subsp. *hancockii* in eastern Burma, southern Yunnan, northern Vietnam, and Sumatra).

Finally, line (xii) itself has two branches that are at first geographically separate. The north-eastern (xiv) includes 24. *H. lagarocladum* and 25. *H. wilsonii* (north-eastern Yunnan

* See couplet 27, p. 208. In using the key, it may be necessary to try both alternatives at this point; but subsequent answers should indicate clearly which one is correct for a given specimen.

north and east to northern Sichuan and Hunan), as well as the western Himalayan 26. *H. dyeri* – another trans-Himalayan disjunction; the south-western (xv) comprises 27. *H. addingtonii* (north-western Yunnan) and the widespread 28. *H. hookerianum*, which has its most primitive forms in western Yunnan, Burma, and Thailand.

(c) Sect. 4. Takasagoya

Sect. *Takasagoya* is clearly related to and derived from *H. monogynum*, in particular from form (i) 'salicifolium', which, as has been explained, is native to Sichuan (Fig. 7). If, as seems possible, *H. monogynum* is truly native in Taiwan, then the geographical disjunction between sects 3 and 4 disappears. At any rate, sect. *Takasagoya* divides into two clear groups; 4. *H. subalatum* (north-eastern Taiwan) has strongly 4-lined stems and leaves that are narrow and acute like those of *H. monogynum* 'salicifolium', but smaller. In the other species the stem becomes 2-lined or terete, and the leaves are broader and obtuse to rounded. Of these, the

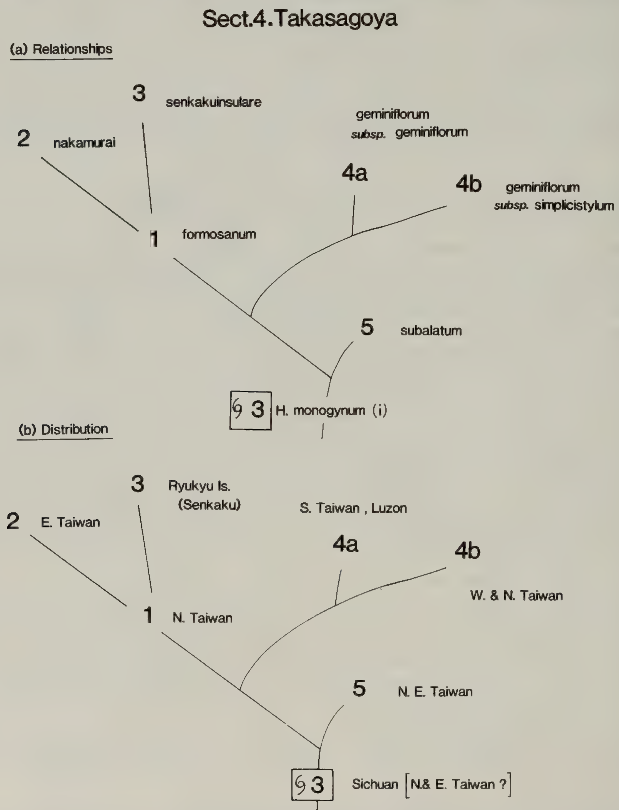


Fig. 7 Sect. 4. *Takasagoya*: (a) Relationships of the 5 species; (b) distribution of the 5 species.

long-sepalled species are in northern and eastern Taiwan (1. *H. formosanum*, 2. *H. nakamurai*) and the Ryukyu Is. (3. *H. senkakuinsulare*), whilst the last species (5. *H. geminiflorum*) is in south Taiwan and the Philippines (Luzon) with a derivate subspecies in the north. Thus here again the branching of the cladogram has a geographical basis.

(d) Sect. 5. Androsaemum

The nearest species in sect. *Ascyreia* to those of the basically Mediterranean and Macaronesian sect. *Androsaemum* is *H. griffithii*, endemic to Bhutan and adjacent India (Arunachal Pradesh). Thus here again we have two taxa with disjunct distributions on either side of the Himalayan massif; and again, as in the case of *H. sherriffii* and *H. reptans*, the nearest ancestral species (*H. oblongifolium*) occupies an intermediate geographical position (western Himalaya). The sect. *Androsaemum* diagram (Fig. 8) branches first to separate a basically eastern group with deciduous sepals (4. *H. hircinum*) from a basically western group with persistent sepals

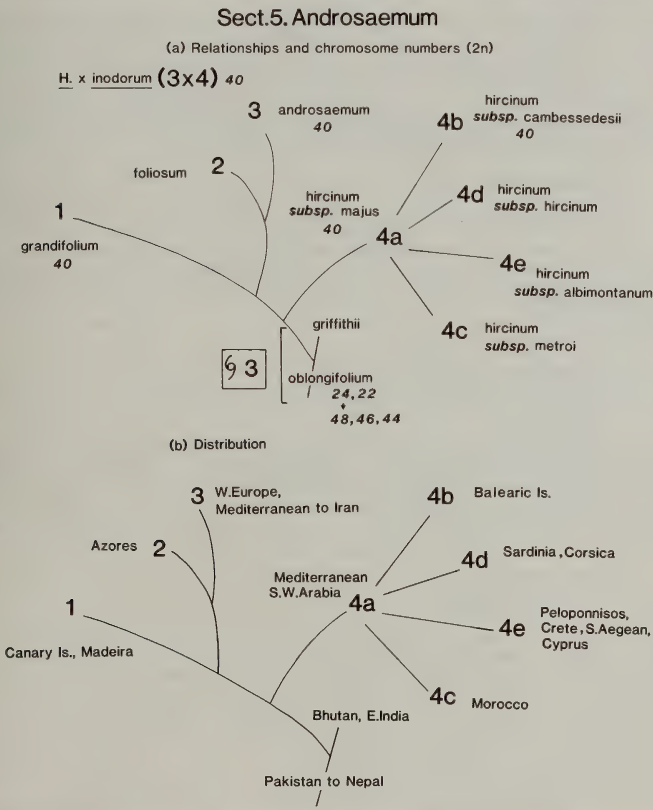


Fig. 8 Sect. 5. *Androsaemum*: (a) Relationships of the 4 species; (b) distribution of the 4 species.

(Spp. 1–3). In the latter, 1. *H. grandifolium* and 2. *H. foliosum* are confined to the Atlantic Islands, whilst 3. *H. androsaemum* has a dissected W. Europe–Mediterranean distribution that extends eastwards to Iran and possibly Turkmenistan. *H. hircinum*, on the other hand, has its most primitive form in the central and eastern Mediterranean (S. Italy, S. Turkey, and the Levant) and south-west Arabia (Asir), with the advanced forms on Mediterranean islands (Balearics, Corsica, Crete, Andhros, Samos, Cyprus) and in the Peloponnisos and Morocco.

(e) Sect. 6. Inodora

The separation of *H. xylosteifolium* (Georgia and adjacent Turkey) from its nearest relative in central China (*H. monogynum* form (ii)) is paralleled in other genera (e.g. *Pterocarya* in the Juglandaceae) and appears to be related to the uplifting of the Himalayan massif and the subsequent increased aridity of central Asia. It is now confined to the wettest (tea-growing) areas in Transcaucasia.

From the above geographical considerations it is possible to draw the general conclusion that, in the relationship diagrams (Figs 1–8), the initial forking of a branch nearly always involves vicariance, i.e. the nearest relatives ('sister groups') rarely occur in the same area. Where they appear to do so (e.g. 8. *H. lobbii* / 9. *H. gracilipes* or 38. *H. lancasteri* / 39. *H. curvisepalum* in sect. 3), then the separation may be ecological (including altitudinal) or cyto-genetical – or possibly only imaginary; every such pair should be examined especially carefully on account of the predominantly vicariance-related speciation in *Hypericum*.

(f) Sect. 6a. Umbraculoides, sect. nov.

When looking through some *Hypericum* material borrowed from the University of København (C), I recently recognised that two specimens from southern Mexico (Oaxaca) not only represented a new species, but also belonged to no hitherto-recognised American section of the genus. Like the two other monotypic sections its relationships are clearly with *H. monogynum* sens. lat.; unlike them (sects 6 and 8), however, the disjunction in distribution is trans-Pacific, not trans-Himalayan.

Sect. 6a. **UMBRACULOIDES** N. Robson, **sect. nov.**

Sect. 3. *Ascyreia* affinis, sed staminorum fasciculis '3' (i.e. 2 + 2 + 1) post anthesin persistentibus, stylis 3, differt.

Fruitex glaber, haud nigro-glandulosus, ramificatione laterali. *Folia* opposita decussata sessilia libera decidua glanduloso-punctata. *Inflorescentia* dichasialis vel monochasialis, e nodo supremo orta. *Flores* stellati homostyli. *Sepala* 5, libera persistentia integra. *Petala* 5, post anthesin decidua, glandulis linearibus vel interruptis instructa. *Staminorum fasciculi* 5, quorum 4 binatim coaliti et 1 liber, post anthesin persistentia, filamentis breviter coniunctis. *Ovarium* trimerum stylis demum liberis. *Capsula* adhuc non visa.

Typus: *Hypericum umbraculoides* N. Robson (p. 318).

Distribution: Mexico (Oaxaca).

The Mexican species has oblong to elliptic, obtuse to rounded, cordate-amplexicaul leaves with densely reticulate venation, like some examples of *H. monogynum* form (ii) 'obtusifolium'; but the inflorescence is corymbose, like a rather condensed version of that in form (i) 'salicifolium' of the same species, and has prompted the choice of epithet *umbraculoides*. It differs from species in sects 3 and 6 in having '3' (i.e. 2 + 2 + 1) persistent stamen fascicles and from sect. 3 in its 3 styles, which are free but appear to be proximally appressed when young. The petals are deciduous, unlike those of *H. xylosteifolium* (sect. 6); and the inflorescence, sepals and leaf-shape are also quite unlike those of that species.

The new species (*Hypericum umbraculoides* N. Robson) cannot therefore be included in any existing sections. It represents an eastward development from *H. monogynum* comparable with

the westward one of *H. xylosteifolium*; but in this case the disjunction is transoceanic. It is similar in latitude to the disjunction in the bambusoid genus *Yushania* Keng fil. (Sichuan/Yunnan to Mexico and Central America) and north of that in *Hydrangea* sect. *Cornidia* (Taiwan/Philippines; Mexico to Argentina) (Stern, 1978). Within *Hypericum*, it is south of the trans-Pacific disjunctions in *H. ascyron* (sect. 7) (E. Siberia to NE. America), *H. concinnum* (sect. 9a, related to *H. ascyron* sens. lat.) (Japan/Sakhalin to California) and sect. 9. *Hypericum* (Japan to S.E. United States and N. Mexico) (see Robson, 1981: 187–192, which requires slight modification owing to the division of sects 7 and 9). One or two trans-Pacific disjunctions are also involved in the Guttiferae – Cratoxyleae, in *Triadenum* and possibly *Thornea* (see Robson, 1981: 182).

There is no reason to doubt that all the above trans-Pacific disjunctions are the result of gradual rather than long-distance dispersal, unlike those in *Hypericum* sect. 30. *Spachium* (Robson, 1981: 214). The more northern ones (especially those of *H. ascyron* and *Triadenum*) may just possibly be the result of dispersal over the Bering Bridge, but it is unlikely that the others are due to such a northern crossing of the Pacific. It is even more unlikely that they crossed via the Antarctic/South America route. Melville's 'Pacifica' (Melville, 1981) would have provided a convenient 'vehicle', as it is thought to form the present eastern part of Asia and western part of North America. However, as I pointed out earlier (Robson, 1981: 212), derivatives of sect. *Ascyreia* migrating northeastward from India could not have reached the western half of 'Pacifica' until it made contact with the rest of Eurasia – by which time the eastern (American) part would be unreachable overland. Perhaps, after all, Styer & Stern (1979) are correct in suggesting that even some of the China–Mexico Pacific disjuncts crossed by the Bering Bridge at a time when the climate in that region was far more temperate than it is today.

2. Systematic treatment

HYPERICUM L.

Sp. pl.: 783 (1753); *Gen. pl.* 5th ed.: 341 (1754). Type species: *H. perforatum* L.

Trees (up to *c.* 12 m tall), shrubs or perennial to annual herbs, glabrous or with simple uniseriate hairs, with glandular canals or lacunae containing resins (amber), essential oils (pellucid or 'pale') and often hypericin and pseudo-hypericin (red to blackish or 'dark'). *Stems* green to yellow-brown or red and with 2–4(–6) raised lines along each internode when young, those lines decurrent from the midrib of the leaf above usually most prominent (sometimes expanded to form narrow wings), eventually usually terete, or wholly terete in some herbs; glabrous or with indumentum; eglandular or with pale to dark glands (sometimes ± prominent) or glandiferous, simple or rarely branched emergences; bark smooth, red-brown to purple-brown or silvery, smooth, thin or rarely corky, exfoliating in sheets, patches or irregular strips, not exuding resiniferous sap or latex. *Leaves* opposite, decussate or sometimes in alternating whorls of 3–4, exstipulate, sessile to shortly and gradually petiolate, sometimes with basal articulation, free or ± united, deciduous at or above the articulation or persistent; lamina entire or occasionally with gland-fringed auricles or base, rarely wholly glandular-denticulate or -fimbriate, venation parallel-dichotomous to pinnate or 1-nerved, open or closed, the tertiary absent to densely reticulate; glands linear to punctiform, pale and/or dark, marginal to laminar; indumentum absent or present. *Inflorescence* terminal, cymose, 1–∞-flowered, elaborated acrotonally by dichasium/monochasium-formation or pseudo-dichotomy or a mixture of both methods ('inflorescence mixed'), basitonally by axillary flowers or flowering branches, sometimes becoming thyrsoid or occasionally racemose by suppression of the terminal bud; transition from leaves to sepals sudden or gradual; bracts and bracteoles often present, usually more similar to sepals, persistent as long as leaves or occasionally (sects 3, 4) caducous. *Flowers* bisexual, actinomorphic, stellate to campanulate or rarely pseudo-tubular, homostylous or rarely dimorphically heterostylous. *Sepals* 4–5 (or abnormally 6 or 3), quincuncial or opposite and decussate (rarely almost open in sect. 20), equal or ± unequal, sometimes foliaceous, free or up to 0·7 united, persistent or occasionally deciduous, with margin entire or glandular-denticulate to -fimbriate or eglandular-fimbriate; veins 1–*c.* 11, parallel or divergent, dichotomising or pinnately branched;

glands marginal to laminar, linear to punctiform, pale and/or dark; indumentum absent or on dorsal surface only. *Petals* lemon to golden yellow or orange or rarely cream or white, often tinged or veined red dorsally where visible in bud or very rarely wholly carmine-red, 4–5 (or abnormally 6 or 3), contorted, equal, free, persistent or deciduous, asymmetrical (except in reduced forms), entire or with sessile marginal glands or glandular-ciliate, usually with ± evident projection at apical point of margin in bud ('apiculus'), rarely with entire and cucullate or trifid and flat ligule; veins numerous to few, sometimes dichotomising or forming loops, reaching margin or not; glands laminar and often marginal, punctiform to linear, pale and/or dark; indumentum absent. *Stamen fascicles* 4–5, antipetalous, free or variously united (2 + 1 + 1 + 1, 2 + 2 + 1, (5), (4)) and then with double fascicles antisepalous, glabrous, persistent or deciduous, each with 1–*c.* 60 stamens; filaments yellow to orange or rarely cream or white or crimson, slender, united towards the base only or apparently free or united to above the middle in a few '3'-fascicled species; anthers yellow to orange or reddish, oblong to elliptic, almost isodiametric, bithecal, with amber to red or blackish gland on connective, dorsifixed (or rarely apparently basifixed, sect. 4), dehiscing introrsely by longitudinal slits; pollen tricolporate, spheroidal to prolate, with exine microreticulate to reticulate or a tectum perforatum. *Staminode fascicles* absent or rarely 3, alternating with 1 + 2 + 2 stamen fascicles, scale-like, entire or bilobed, functioning like grass lodicules. *Ovary* 2–5-merous, glabrous, with placentation incompletely to completely axile or ± parietal; styles 2–5, elongate, free or partially or completely united, with stigmas distinct, minute to capitate; ovules 2–∞ on each placenta, erect to horizontal or pendulous. *Fruit* capsular, 2–5-valved, dehiscing septicidally from the apex, with valves somewhat woody or coriaceous to papyraceous, persistent or rarely deciduous, rarely tardily dehiscent or indehiscent with valves ± fleshy and coloured red to blackish, valves 1–∞-seeded; vittae often ± prominent, linear or punctiform ('vesicles'), amber or rarely blackish; styles wholly or partially persistent. *Seeds* small (0·3–1·5 mm long), narrowly cylindric to ovoid-cylindric or ellipsoid, slightly curved or usually straight, without or with a prominent unilateral carina or thin and papyraceous wing, without or with an apical and sometimes also basal expansion, wing-like or thick, or rarely an apical whitish caruncle (sect. 25); testa yellow-brown to red-brown or purple-brown ('blackish') with sculpturing ± prominently reticulate or linear-reticulate to foveolate or scalariform or papillose; endosperm absent; embryo slender, straight, with cotyledons equal, free, plano-convex, shorter than hypocotyl.

Basic chromosome numbers (x): 12, 11, 10, 9, 8, 7, 6; ploidy 2–6.

Habitat: Dry, semi-desert areas (e.g. southern Turkey and adjacent Syria and Iraq) to shallow water, in cold temperate to warm temperate climates.

Distribution: World-wide except for (1) southern Chile, Argentina and the Antarctic regions, (2) southern Oceanic islands, (3) tropical lowlands (excluding *H. japonicum*, which occurs there as a rice-field weed), (4) Arctic, subarctic, and alpine regions. Apparently absent from the following territories: Alaska, Falkland Is., Antarctica, Greenland, Iceland, Svalbard, Lesser Antilles, Trinidad, Tobago, Dutch W. Indies, Surinam, Cayenne, Cape Verde Is., S. Atlantic Is., W. Sahara–Mali–Niger–Dahomey westward (except Guinea), Central African Republic, Gabon, Congo–Brazzaville, S. Tomé, Principe, Annobon, Equatorial Guinea (mainland), Aldabra, Seychelles, Mauritius, Rodriguez, Indian Ocean islands, Kuwait, Arab Emirates, Oman, Bahrain, Qatar, S. Yemen (mainland), Mongolia, Pacific Ocean islands (except New Caledonia, Hawaii, Galapagos, and Revilla Gigedos Islands).

Key to sections
See Robson (1977*a*: 342–344).

Sect. 1. **CAMPYLOSPORUS** (Spach) R. Keller

in Engler & Prantl, *Nat. Pflanzenfam.* **3**(6): 209 (1893).

Trees or shrubs up to 12 m tall, evergreen, glabrous, with or without dark glands; branching lateral. *Stems* 4-lined and ± compressed when young, becoming terete, eglandular; cortex

exfoliating in longitudinal strips; bark fissured, scaly. *Leaves* opposite, decussate, sessile or rarely very shortly petiolate, free, deciduous at basal articulation; lamina entire, with venation parallel-dichotomous to pinnate, open or closed, the tertiary absent or ± densely reticulate; laminar glands linear to punctiform, pale; marginal gland dots dark and/or pale; vental glands absent. *Inflorescence* 1–9(–∞)-flowered, branching dichasial/monochasial from 1–2(–4) nodes, sometimes with subsidiary flowering branches from lower nodes; bracts and bracteoles foliar or transitional. *Flowers* stellate to cyathiform or rarely campanulate, homostylous. *Sepals* 5, free, persistent, spreading to reflexed in fruit, with margin entire to denticulate or ciliolate; veins numerous; laminar glands pale, linear or rarely interrupted to punctiform; submarginal dark glands present or absent; marginal or inframarginal glands absent or dark (or rarely reddish). *Petals* 5, persistent or sometimes tardily deciduous, with apiculus present, lateral, rounded, ± prominent or rarely almost absent, margin entire or ± minutely glandular-ciliate; marginal glands absent or amber to dark; laminar glands ± numerous, pale, linear and often interrupted distally, very rarely also dark dots or short streaks. *Stamen fascicles* 5, free, persistent or rarely tardily deciduous, each with 20–45(–80) stamens; filaments united very shortly or for up to 5 mm; anthers yellow, gland amber; pollen type I. *Ovary* with 5 incompletely axile placentae (united at the base, free but deeply intrusive above), each ∞-ovulate; styles 5, partly or wholly coherent or very rarely almost free; stigma subglobose (or rarely bilobed) to small and rounded. *Capsule* 5-valved, coriaceous, not vittate. *Seeds* ± narrowly cylindric to fusiform, sometimes shallowly carinate, rarely with apical wing expansion; testa linear-reticulate or rarely linear-foveolate.

BASIC CHROMOSOME NUMBER (x): 12; ploidy 2.

HABITAT: open montane or mid-altitude forest, deciduous forest, fringing forest, heathland, grassland, rocky places, 210–4000 m.

DISTRIBUTION: SW. Arabia (Asir, Yemen) and Socotra; tropical and subtropical Africa from Guinée, Nigeria, Sudan Republic and Ethiopia south to northern Cape Province; Fernando Poo; Comoro Is. (Grand Comore), Madagascar, and Réunion.

10 species (+ 3 subspecies).

Key to sect. 1. *Campylosporus*

1 Petals erect at anthesis; stamen filaments united for 2–5 mm; leaf venation wholly dichotomous or with one pair of basal midrib branches .... 1. ***bequaertii*** (p. 180)
Petals spreading or reflexed at anthesis; stamen filaments united for 1 mm or less; leaf venation usually at least partly pinnately branched or reticulate 2

2(1) Flowers all solitary; petals and stamens persistent; main leaf-venation either open or closed by cross-veins to form complete intramarginal vein 3
Flowers (at least some) in 2–∞-flowered inflorescences or, if all solitary (Sp. 6a), then petals and sometimes stamens tardily deciduous; main leaf-venation either open or closed by branches from midrib to form incomplete intramarginal vein 7

3(2) Styles outcurved above; sepals outcurved in bud; stamens 30–40 per fascicle (2. ***revolutum***) 4
Styles ascending above or wholly appressed; sepals erect in bud; stamens 20–25 per fascicle 5

4(3) Leaves without or with 1–2 pairs of cross-veins not interrupting parallel veins; pedicel 5–8 mm long; stamens *c.* 40 per fascicle, equalling or exceeding styles .... 2a. ***revolutum*** subsp. ***keniense*** (p. 184)
Leaves with 3–8 pairs of cross-veins interrupting parallel veins; pedicel 1–5 mm long; stamens 30–35 per fascicle, shorter than or equalling styles .... 2b. ***revolutum*** subsp. ***revolutum*** (p. 185)

5(3) Styles 0·9 coherent or less; sepals ovate to triangular-ovate (3. ***lanceolatum***) 6
Styles completely coherent; sepals elliptic or lanceolate to narrowly oblong .... 4. ***madagascariense*** (p. 191)

6(5) Leaves without or with 1–2 pairs of cross-veins not interrupting parallel veins; leaf lamina concolorous, margin plane; styles *c.* 1·2–1·5 × ovary, 0·6–0·7 coherent........................ 3a. ***lanceolatum*** subsp. ***angustifolium*** (p. 190)
Leaves with 3–10 pairs of cross-veins interrupting parallel venation; leaf lamina ± discolorous, margin usually ± revolute; styles *c.* 1·8–3 × ovary, 0·8–0·9 coherent.................... 3b. ***lanceolatum*** subsp. ***lanceolatum*** (p. 190)

7(2) Styles 1–1·2 × ovary, separating ± completely in fruit; petals and sometimes stamens tardily deciduous; dark glands absent; leaves with midrib branches often not reaching main laterals (5–6. ***socotranum*** sens. lat.) 8
Styles 1·2–3 × ovary, remaining united in fruit; petals and stamens persistent (or tardily deciduous in Sp. 7); dark glands present (except in Sp. 8); leaves with midrib branches reaching main laterals.. 10

8(7) Leaves ± narrowly elliptic (l: b = 3–6), acute; sepals ovate to ovate-oblong (3·2–5·5 mm wide), acute to obtuse, entire to denticulate; ovary ovoid; growing on granite .... 5. ***balfourii*** (p. 191)
Leaves elliptic to oblanceolate or subcircular (l: b = 1·3–2), acute or apiculate to rounded; sepals oblong (2·5–3 mm wide), apiculate to rounded, entire; ovary ovoid to ovoid-conic; growing on limestone (6. ***socotranum***) 9

9(8) Pedicels 1–6 mm long; leaves elliptic to oblanceolate (5–10 mm wide), acute to obtuse; flowers solitary .... 6a. ***socotranum*** subsp. ***socotranum*** (p. 193)
Pedicels 5–11 mm long; leaves broadly elliptic to subcircular (8–22 mm wide), apiculate to rounded; flowers 1–5 .... 6b. ***socotranum*** subsp. ***smithii*** (p. 194)

10(7) Leaves without or with very laxly reticulate venation; petals tardily deciduous.................. 11
Leaves with densely reticulate venation; petals persistent.. 12

11(10) Leaves sessile, 16–90 mm long; sepals ovate-lanceolate to triangular-lanceolate, 2–5 mm wide; leaves, sepals and petals with dark glands .... 7. ***quartinianum*** (p. 194)
Leaves petiolate, 10–30 mm long; sepals linear-lanceolate, 1·7–2 mm wide; leaves, sepals and petals with only pale or reddish glands .... 8. ***synstylum*** (p. 197)

12(10) Leaves with ± punctiform laminar glands; styles wholly united or almost so .... 9. ***roeperianum*** (p. 198)
Leaves with linear to striiform laminar glands; styles *c.* 0·7 united......... 10. ***gnidiifolium*** (p. 201)

1. **Hypericum bequaertii** De Wild.

in *Rev. zool. afr.* **8**, suppl. bot.: 4 (1920) ('*Bequaerti*'); *Pl. bequaert.* **1**: 241 (1922); Good in *J. Bot., Lond.* **65**: 333, t. 582 f. 14 (1927); Hauman in *Bull. Acad. r. Belg., Cl. Sci.* V, **19**: 705 (1933); Milne-Redh. in *Fl. trop. E. Afr.* Hyperic.: 5 (1953); Hedberg in *Symb. bot. upsal.* **15**(1): 130 (1957); Robson in *Kew Bull.* **12**: 444 (1958); Spirlet, *Contr. fl. Congo.* Guttif.: 10 (1966); Bamps in *Fl. Congo, etc.* Guttif.: 10, t, l, f. 1D (1970), in *Bull. Jard. bot. natn. Belg.* **41**: 441 (1971), *Distr. pl. afr.* **3**: map 74 (1971); Robson in Bamps, Robson & Verdcourt, *Fl. trop. E. Afr.* Guttif.: 28 (1978), in *Kew Bull.* **33**: 581 (1979). Type: Zaïre, Ruwenzori, Butahu [Butagu] Valley, 3800–4200 m, 7.iv.1914, *Bequaert* 3757 (BR, holotype; K!).

H. keniense sensu Mildbr., *Deutsch. Zentr.-Afr.-Exped. 1907–1908* **2**: 560 (1913); Staner in *Bull. Jard. bot. État Brux.* **13**: 72 (1934); Lebrun in *Bull. Agric. Congo belge* **25**: 423 (1934); Robyns, *Fl. Parc Nat. Albert* **1**: 624 (1948); Dale, *Indig. trees Uganda*: 157 (1952); pro parte omnes, quoad syn. *H. bequaertii*.

Icones: Bamps in *Fl. Congo, etc.* Guttif.: t. 1, f. 1D (1970); Fig. 9.

Shrub or tree to 10(–12) m tall, often rather bushy, with branches ascending. *Stems* red when young, soon terete; internodes 2–6 mm long, much shorter than leaves; bark grey-brown. *Leaves** sessile; lamina (10–)18–55(–60) × 4–15 mm, narrowly

* The leaves and petals in the text figures are all three-quarters of natural size unless otherwise indicated.

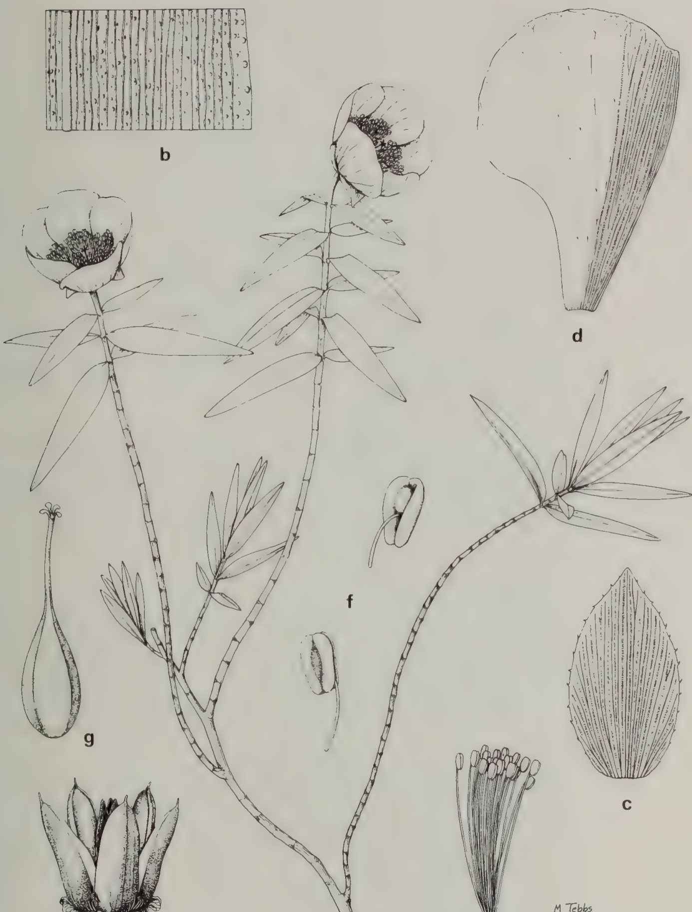
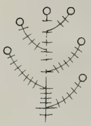


Fig. 9 *H. bequaertii*: (a) habit: (b) leaf section; (c) sepal; (d) petal; (e) stamen fascicle; (f) anthers; (g) ovary; (h) capsule (a × 1; h × 2; c–e, g × 4; b × 12, f × 20). All *Taylor* 3023.

lanceolate to narrowly elliptic, acute, margin plane, base cuneate, reflexed-auriculate, concolorous, often glaucous, subcoriaceous, lower ones soon deciduous; venation: (3)5 basal or near-basal veins, unbranched, alternating with numerous parallel dichotomising (non-functional ?) secondary veins, without midrib branches or cross-veins; laminar glands in secondary venous system, uninterrupted, alternating with ± irregular series of small dots, and with a few scattered large resin glands; marginal glands pale, sparse. *Inflorescence* 1-flowered; pedicel *c.* 10 mm long; bracts foliar but smaller and broader. *Flowers* 40–75 mm in diam., cyathiform to campanulate; buds ovoid, acute. *Sepals* 14–20 × 8–12 mm, imbricate, ± unequal, soon recurved in bud, broadly to narrowly ovate, acute to subacute, margin entire to irregularly denticulate or ciliolate, midrib undifferentiated; laminar glands linear, numerous; submarginal glands absent or rarely few; marginal glands absent or dark. *Petals** orange (? to bright yellow), flushed red outside, persistent, erect, 27–35 × 16–25 mm, 1·7–2 × sepals, obovate, with apiculus small, rounded; margin entire, eglandular; laminar glands linear, interrupted distally. *Stamen fascicles* persistent, each with *c.* 30 stamens, longest 20–28 mm long, *c.* 0·7 × petals, with filaments united for 2–5 mm. *Ovary c.* 10 × 5 mm, ovoid-cylindric; styles *c.* 12 mm long, *c.* 1·2 × ovary, 0·75 coherent, suberect distally; stigmas subglobose, sometimes bilobed. *Capsule* 20–22 × 13–15 mm, ovoid-cylindric. Seeds dark reddish-brown, *c.* 1·5 mm long, cylindric, not carinate, linear-reticulate. 2n = ?



'In moist or protected localities, co-dominant in open forest or bush, occurring in the upper part of the ericaceous belt and the lower part of the alpine belt' (Hedberg, 1957: 131); (3150)3350–4350 m.

†Zaïre (Ruwenzori), Uganda (Ruwenzori). Map 1.

ZAIRE. Kivu: Terr. Beni, Ruwenzori, Parc National Albert, viii. 1948, *Robyns* 3316 (K); Upper Ruanoli Valley, 3720 m, i.viii.1952, *Ross* 737 (BM).

UGANDA. Western: Toro distr., Ruwenzori; Namwamba Valley, Kilembe, 3600 m, 9.i.1936, *Taylor* 3023 (BM); Kitandara, 3600 m, viii.1953, *Osmaston* 3761 (K).

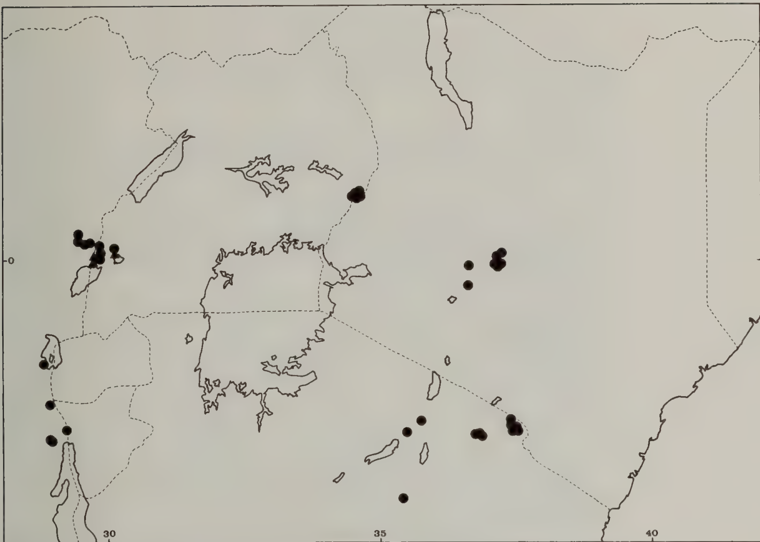
H. bequaertii has the greatest number of primitive characters of any species of *Hypericum*. These include the parallel-dichotomous leaf venation, the large, solitary flowers with massive parts, and the virtual absence of dark glands. The cyathiform corolla and the relatively long union of the stamen filaments could be either primitive or specialisations associated with high-altitude conditions.

H. bequaertii is closely related to *H. revolutum* subsp. *keniense*, which also occurs on Ruwenzori but has a lower (but overlapping) altitudinal range and appears to grow in somewhat drier habitats. *H. bequaertii* may be distinguished from it by the persistently cyathiform to campanulate, largely red-tinged corolla. Both these taxa are distinguished from the remaining mainland species of sect. *Campylosporus* by the presence of a papillose epidermis (cf. Spirlet (1967: 13–19)).

2. **Hypericum revolutum** Vahl

Symb. Bot. **1**: 66 (1790); Christensen in *Dansk bot. Ark.* **4**: 39 (1922); Robson in *Kew Bull.* **14**: 251 (1960), in *Fl. Zamb.* **1**: 381 (1961), in Bamps, Robson & Verdcourt, *Fl. trop. E. Afr.* Guttif.: 28 (1978), in *Kew Bull.* **33**: 581 (1979); Paiva in *Mems Jta Invest. Ultramar* (Bot.) II, No. 38: 76 (1963); Spirlet, *Contr. fl. Congo* Guttif.: 7, f. 1A–C (1966), in *Bull. Inst. fr. Afr. noire* A, **29** (1): 13, t. 1 f. 12 (1967); Moggi & Pisacchi in *Webbia* **22**: 236, f. 1, map 1 (1967); Bamps, *Fl. Congo. etc.* Guttif. 8, f. 1A, B (1970), in *Bull. Jard. bot. natn. Belg.* **41**: 438 (1971), in *Distr. Pl. Afr.* **3**: map 72 (1971) pro parte, excl. loc. Comores et Réunion; Lisowski, Malaisse & Symoens in *Bolm Soc. broteriana* II, **44**: 232 (1970); Agnew, *Upl. Kenya wild fls*: 186 (1974); Killick & Robson in *Fl. sthn Africa* **22**: 15 (1976); Troupin, *Fl. Rwanda, Sperm.* **1**: 299, f. 63 (1) (1978), *Fl. Pl. lign. Rwanda*: 215, f. 72, 1 (1982). Types: Yemen, Arabia felix, 1763, *Forsskål* 796 (C!, lectotype – mihi); ibid., *Forsskål* 792 (C!, syntype).

† All specimens cited in geographical lists have been seen by the author unless otherwise indicated. The lists are not necessarily comprehensive, those for the commoner species having been compiled to illustrate distribution.



Map 1 Sect. 1. *Campylosporus*: 1, *H. bequaertii* ▲, 2a. *H. revolutum* subsp. *keniense* •.

Shrub or tree (0·3–)1–10(–12) m tall, bushy or slender, with branches ascending to spreading. *Stems* red to yellow-brown when young, soon 2-lined, eventually terete; internodes 2–6 mm long, much shorter than leaves; bark dark brown to grey. *Leaves* sessile; lamina (11–)15–45(–60) × 2·5–12 mm, ± narrowly elliptic to narrowly oblong or very rarely oblanceolate, acute, margin plane to recurved, base cuneate, reflexed-auriculate, paler beneath, sometimes glaucous, subcoriaceous to chartaceous, lower ones ± soon deciduous; venation: (1)3–5 basal or near-basal veins, laterals branching dichotomously (mostly near the base), with numerous parallel or interrupted and ± vestigial secondary veins, without or with 1–8 cross-veins and a loose or ± dense tertiary reticulum; laminar glands in secondary venous system either (i) not interrupted and alternating with ± irregular series of small dots and short streaks or (ii) interrupted and wholly streaks and lines or with a few dots; marginal glands pale to dark, sparse to dense. *Inflorescence* 1-flowered; pedicel 1–8 mm long; bracts foliar but smaller and broader. *Flowers* (35)40–80 mm in diam., stellate; buds ovoid to subglobose, acute to rounded. *Sepals* 5–18 × 3–9 mm, imbricate, ± unequal, soon recurved in bud, broadly to narrowly ovate or subcircular, acute to subrounded, margin entire or usually ± irregularly glandular-denticulate or -ciliolate, midrib undifferentiated or obscure; laminar glands linear, numerous; submarginal glands absent or dark; marginal glands absent or dark. *Petals* orange-yellow to golden-yellow, flushed red to orange outside, persistent, spreading, 15–40(–43) × 5–26 mm, 2·3–3 × sepals, obovate-oblanceolate to oblanceolate, with apiculus small, rounded; margin entire or with a few dark sessile glands or glandular cilia; laminar glands linear, interrupted distally. *Stamen fascicles* persistent, each with 30–40 stamens, longest 11–20 mm long, *c.* 0·5 × petals, with filaments united for *c.* 1 mm. *Ovary* 3·5–9 × 3·5–5·5 mm, ovoid to ovoid-globose; styles 4–12 mm long, 0·8–1·6 × ovary, *c.* 0·8 coherent, spreading distally; stigmas subglobose to narrowly capitate. *Capsule* 9–15 × 7–11 mm, ovoid to subglobose. *Seeds* reddish-brown, 1·2–1·5 mm long, ±

narrowly cylindric, sometimes narrowly carinate and/or with distal expansion, finely linear-reticulate. 2n = 24 (both subspecies).

In open forest, forest margins, savannas, and grassland; 900–4000 m.

From SW. Arabia and Ethiopia to the Transvaal; also in Cameroon and Fernando Poo. Maps 1, 2.

H. revolutum comprises two subspecies (Robson, 1979), one widespread (subsp. *revolutum*), the other confined to the East African mountains (subsp. *keniense*).

2a. **H. revolutum** subsp. **keniense** (Schweinf.) N. Robson

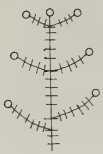
in Bamps, Robson & Verdcourt, *Fl. trop. E. Afr.* Guttif.: 28 (1978), in *Kew Bull.* **33**: 582 (1979). Type: Kenya, Mt. Kenya, western slope at 1150 m, 1887, *von Hoehnel* (B†, holotype; BM [fragment]!)

H. keniense Schweinf. in von Hoehnel, *Reise Rudolfsee*: 15, 868 (1892); Engler in *Phys. Math. Abh. K. Akad. Wiss. Berlin* **1891**: 308 (1892), *Pflanzenw. Ost-Afr.* **C**: 274 (1895) pro parte, quoad spec. ex Kenia; Engler & Diels, *Veg. der Erde* **3** (2): 499 (1921) pro parte, quoad spec. ex Kenia; T. C. E. Fries in *Notizbl. bot. Gart. Mus. Berlin* **8**: 565 (1923); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925); Good in *J. Bot., Lond.* **65**: 333, t. 582 ff. 12, 13 (1927); Dale, *Indig. trees Uganda*: 157 (1952); Milne-Redh. in *Kew Bull.* **8**: 434 (1953), in *Fl. trop. E. Afr.* Hyperic.: 5 (1953); Hedberg in *Symb. bot. upsal.* **15** (1): 130 (1957), *Feat. Afroalpine pl. ecol.*: 89 (1964); Dale & Greenway, *Kenya trees & shrubs*: 235 (1961); Spirlet, *Contr. fl. Congo* Guttif.: 10, f. 1D (1966), in *Bull. Inst. fr. Afr. noire* A, **29** (1): 16, t. 1 ff. 14–15 (1967); Bamps in *Fl. Congo etc.* Guttif.: 10, f. 1C (1970), in *Bull. Jard. bot. natn. Belg.* **41**: 440 (1971), in *Distr. pl. Afr.* **3**: t. 73 (1971); Agnew, *Upl. Kenya wild fls.*: 186 (1974); Troupin, *Fl. Rwanda, Sperm.* **1**: 299, f. 63 (2) (1978).

H. ruwenzoriense De Wild. in *Rev. zool. afr.* **8** suppl. bot.: 5 (1920); *Pl. Bequaert.* **1**: 242 (1922); Good in *J. Bot., Lond.* **65**: 333, t. 582 (1927); Staner in *Bull. Jard. bot. État Brux.* **13**: 71 (1934); Lebrun in *Bull. Agric. Cong. belg.* **25**: 423 (1934); Robyns, *Fl. Parc Nat. Albert* **1**: 623 (1948); Brenan, *Checkl. Tang. Terr.* **2**: 250 (1949); Dale, *Indig. trees Uganda*: 159 (1952); Spirlet, *Contr. fl. Congo* Guttif.: 8, f. 1E–F (1966), in *Bull. Inst. fr. Afr. noire* A, **29** (1): 16, t. 1 f. 13 (1967). Type: Zaïre, Ruwenzori, Butahu [Butagu] Valley, *Bequaert* 3705 (BR).

Icon: Bamps in *Fl. Congo. etc.* Guttif.: f. 1 C (1970).

Stems red when young. *Leaves* with 3–5 basal or near basal veins, without or with 1–2 cross-veins not interrupting the numerous parallel secondary veins or changing their direction. *Pedicel* 5–8 mm long. *Flowers* 45–80 mm in diam.; buds acute to obtuse. *Sepals* narrowly to broadly ovate. *Petals* flushed red outside. *Stamen fascicles* each with *c.* 40 stamens equalling or exceeding styles. *Styles* 7–12 mm long. *Capsule* (10)12–15 mm long.



'In open forest or bush on comparatively dry ground, occurring from the montane forest belt into the lower part of the alpine belt' (Hedberg, 1957: 130); (1850–)2400–3750(–4000) m.

Zaïre (Ruwenzori, Mt. Muhi, Mt. Kahuzi), Uganda (Ruwenzori, Elgon), Kenya (Elgon, Aberdares, Mt. Kenya), Tanzania (Kilimanjaro, Meru, Hanang, Loolmalasin). Map 1.

ZAIRE. Kivu: Ruwenzori, Butahu valley, Mutsora–Kalonge path, 2000 m, 13.vii.1954, *Osmaston* 3301 (BM); Terr. Kalehe, Mont Kahuzi, flanc est, 3240 m, 29.xii.1971, *Bamps* 2894 (BR).

UGANDA. Western: Toro distr., Ruwenzori, Bujuku valley, near Bigo camp, 3450 m, 1.iv.1948, *Hedberg* 624 (K); Mbale distr., Mt. Elgon, above Butandiga, 2100 m, viii.1934, *Synge* 864 (BM).

KENYA. Rift Valley: Trans-Nzoia distr., Mt. Elgon (north-east), 3360 m, iii.1960, *Tweedie* 1985 (K); Naivasha distr., Aberdare Range, Kinangop, 3600 m,

17.vii.1948, *Hedberg* 1629 (K). Central: N. Nyeri distr., Mt. Kenya, Sirimon track, 3000 m, 30.xii.1974, *Williams* 70 (K).

TANZANIA. Northern: Moshi distr., Kilimanjaro, Marangu, 2850 m, 17.xii.1960, *F. G. Smith* 1401 (K); Arusha distr., Mt. Meru, eastern slope, 2500–3150 m, 6.1.1971, *Vänskä* (H); Mbulu distr., Loolmalassin Mtn, 3300–3570 m, 17.ix.1932, *Burtt* 4211 (K).

H. revolutum subsp. *keniense* is the nodal taxon in sect. *Campylosporus* (and hence in *Hypericum* as a whole). Only *H. bequaertii* has more primitive characters, and even its claim to overall primacy in this respect is open to doubt. Subsp. *keniense* is very closely related to *H. lanceolatum* subsp. *angustifolium* (q.v.) from Réunion, but can be distinguished from it *inter alia* by the outcurving sepals and styles.

The distinctions between subsp. *keniense* and subsp. *revolutum* are less clear, despite the length of the differential descriptions. Intermediate specimens are not infrequent at altitudes between 1800 and 3600 m, especially in the east and south of the distribution of subsp. *keniense*. Thus, whereas pure forms of the subspecies are common on Ruwenzori and Mt. Elgon, they are rarer in the Aberdares and on Mt. Kenya; on the Tanzanian volcanoes they are much less common than the intermediates. In an earlier paper (Robson, 1979), I have suggested that the incomplete evolution of subsp. *revolutum* from subsp. *keniense* is likely to have occurred before the elevation of the East African volcanoes.

2b. **H. revolutum** subsp. **revolutum**

H. kalmii Forssk., *Fl. aegypt.-arab.*: cxviii (1775), nomen.

H. kalmianum Vahl, *Symb. bot.* **1**: 66 (1790), in synon., non L. (1753).

H. leucoptychodes Steudel [in sched. *Pl. Schimper. Abyss.* 834, 1177; Delile in Rochet d'Héricourt, *Sec. voy. Choa*: 339 (1846)] ex A. Rich., *Tent. fl. abyss.* **1**: 96 (1847); Good in *J. Bot., Lond.* **65**: 330, t. 582 ff. 3–5 (1927); Norlindh in *Bot. Notiser* **1934**: 100 (1934); Brendell in *Bothalia* **3**: 580, map (1939); Phillips in *Flower. pl. S. Afr.* **20**: t. 787 (1940); Brenan, *Checkl. Tang. Terr.* **2**: 249 (1949); Andrews, *Fl. pl. Anglo-Egyptian Sudan* **1**: 213 (1950); Dale, *Indig. trees Uganda*: 157, t. 33 (1952); Pardy in *Rhodesia Agric. J.* **53**: 514, tt. 515–6 (1956). Types: Ethiopia, Ametscha prope Dschenausa, 1.i.1840, *Schimper* 834 (P, lectotype –mihi; FI, G, K!, L, LE, M, MO, PAL, S, Z); in latere boreali montis Bachit, 6.vi.1838, *Schimper* 1177 (FI, G, K!, LE, P).

H. lanuriense De Wild., *Pl. bequaert.* **5**: 403 (1932); Robyns, *Fl. Parc. Nat. Albert* **1**: 622 (1948). Types: Zaïre, Ruwenzori, Ruanoli [Lanuri] Valley, *Bequaert* 4460 (BR, lectotype; K!, photo); Zaïre, Ruwenzori, vallée du Batagu vers 300 m, *Bequaert* 3716 (BR).

H. lanceolatum sensu Choisy, *Prod. monogr. fam. Hypéric.*: 41 (1821), in DC., *Prodr. syst. nat. regni veg.* **1**: 545 (1824); Oliver, *Fl. trop. Afr.* **1**: 156 (1868) pro parte, excl. typum; R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* **3** (6): 209, f. 100 T, U (1895) pro parte, 2nd ed. **21**: 176 (1925) pro parte; Engler, *Pflanzenw. Ost-Afr.* **C**: 274 (1895), in von Götzen, *Durch Afr. von. O. nach W.*: 376 (1895), in Mildbraed, *Deutsch. Zentr.-Afr.-Exped. 1907–1908* **2**: 560 (1913), in Engler & Diels, *Veg. der Erde* **3** (2): 497, t. 229 (1921); Th. & H. Durand, *Syll. pl. Afr.*: 43 (1909); Baker f. in *J. Linn. Soc.* (Bot.) **40**: 26 (1911); Mildbraed in H. Meyer, *Mitt. Deutsch, Schutzgeb.* Ergänzungsch. **6**: 96 (1913); R. E. Fries, *Wiss. Ergebn. Schwed. Rhod. Kongo Exp. 1911–1912* **1**: 150 (1914); Eyles in *Trans. R. Soc. S. Afr.* **5**: 420 (1916); De Wild., *Pl. bequaert.* **1**: 241 (1922); T. C. E. Fries in *Notizbl. bot. Gart. Mus. Berlin* **8**: 565 (1923); Staner in *Bull. Jard. bot. État Brux.* **13**: 74 (1934); Robyns, *Fl. Parc Nat. Albert* **1**: 620, t. 62 (1948); Milne-Redh. in *Fl. trop. E. Afr.* Hyperic.: 4 (1951), in *Mem. N.Y. bot. Gdn* **8** (3): 221 (1953); Keay & Milne-Redh. in *Fl. W. trop. Afr.* 2nd ed. **1** (1): 287, t. 109 (1954); N. Robson in *Kew Bull.* **12**: 444 (1958) pro parte, quoad loc. Afric.; Pellegrin in *Bull. Soc. bot. Fr.* **106**: 217 (1959); Cufod. in *Bull. Jard. bot. État. Brux.* **29** suppl.: 588 (1959); Dale & Greenway, *Kenya trees & shrubs*: 235, f. 46 (1961); Mooney in *Proc. Linn. Soc. Lond.* **174**: 147, t. 2a (1963); Gilli in *Annln naturh. Mus. Wien* **74**: 425 (1970); pro parte omnes, non Lam. (1797).

Icon: Moggi & Pisacchi in *Webbia* **22**: 239, f. 1 (1967).

Stems yellow-brown when young. *Leaves* with 3 basal veins, with 3–8 cross-veins interrupting the ± numerous secondary veins and often changing their direction. *Pedicel* 1–5 mm long. *Flowers* 35–55 mm in diam.; buds obtuse to rounded. *Sepals* broadly ovate to subcircular. *Petals* flushed orange outside. *Stamen fascicles* each with 30–35 stamens shorter than or equalling styles. *Styles* 4–8 mm long. *Capsule* 9–12(–14) mm long.

Montane forest margins, fringing forest, secondary forest, scrub, savannahs and grassland on dry or marshy ground; 900–4000 m.

Saudi Arabia (Asir), Yemen, Equatorial Guinea (Fernando Poo), Cameroun, Nigeria, Ethiopia, Sudan Republic, Kenya, Uganda, Zaïre, Burundi, Rwanda, Tanzania, Malawi, Zambia, Zimbabwe, Mozambique, Swaziland, South Africa (Transvaal, Natal, Cape Prov.). Map 2.

SAUDI ARABIA. Asir: Suda [Al Sudah], 3000 m, i.vii.1946, *Vesey-Fitzgerald* 16086/1 (BM).

YEMEN. Taiz, Jebel Sabir, 2400–2700 m, 21.x.1975, *Hepper* 5948 (K).

EQUATORIAL GUINEA. Fernando Poo: Moka region, 1350–1500 m, 30.i.1933, *Exell* 798 (BM).

NIGERIA. Eastern: Chappal Waddi (Gangirwal), 1500–2400 m, 19.xi.1969, *Jackson, Magaji & Tuley* 2084 (K).

CAMEROON. West; Cameroon Mtn, Mann's Spring, slopes of Vefondi, 2890–2050 m, i.iv.1948, *Brenan, Jones & Richards* 9556 (K).

SUDAN REPUBLIC. Equatoria [El Istwaya]: Didinga Mts, Mt. Lotuke, 2700 m, iii.1939, *Macdonald* 100 (BM).

ETHIOPIA. Eritrea: Scimenzana, sul monte Guna guna, 21.ix.1902, *Pappi* 225 (BM, K). Tigray: Urahut, 2400 m, 28.i.1862, *Schimper* 906 (BM, E). Gonder: Wolkofit Pass, 3000 m, 25.v.1953, *Greathead* 95 (BM, EA). Gojjam: Choké Mts, W. side of upper Godeb gorge, *c.* 2700 m, 30.viii.1957, *Flenley & Hillier* 266 (K). Shoa: Entotto Mtn, 2850 m, 29.i.1965, *Perdue* 6435 (K). Keffa: Jimma area, Red Mtn, Aba dima Farm, 10.i.1962, *Siegenthaler* 1624 (EA, K). Gamo-Gofa: Gamò, Borodda to Ciencia, 5.ii.1938, *Vatova* 1698 (FI). Sidamo: Amaro Mts, E. slope of Mt. Delo, 2400–3000 m, *Gillett* 14912 (K). Arssi: Mt. Boroluccu, *c.* 50 km SE. of Asella, *de Wilde* 10060 (K). Bale: Stella Waghe near Gurio, 3600 m, 4.iv.1958, *Mooney* 7114 (K). Harerghe: Kondudo Mtn, 2400–2700 m, 4.xi.1961, *Burger* 1221 (K).

KENYA. Northern Frontier: Mt. Nyiru, 2700 m, 5.i.1959, *Newbould* 3438 (K). Rift Valley: S. Kinangop, Chenia stream, 2490 m, 22.xi.1953, *Verdcourt* 1034 (K). Central: Mt. Kenya (N. sector), Timberless Gap, 2720 m, 29.vii.1949, *Schelpe* 2456 (BM). Masai: Narok, Enesambulai Valley, 2640 m, 12.ix.1970, *Greenway & Kanuri* 14571 (K).

UGANDA. Northern: Karamoja, Morongole Mtn, 2580 m, ii.xi.1939, *Thomas* 3318 (K). Western: Kigezi, Mt. Muhavura, 2100–2400 m, 17.x.1929, *Snowden* 1514 (BM, K). Eastern: Mt. Elgon, Butandinga, 2250 m, *Dale* U.18 (K).

ZAIRE. Haute Zaïre: Terr. Djugu, Mt. Oboro (L. Albert), 2450 m, 26.iii.1958, *Bamps* 149 (K). Kivu: Terr. Mwenga, Mt. Muhi, 3045 m, 31.viii.1955, *Kinet* 94 (K). Shaba: environs de Kasiki, R. Lunangwa, 2050 m, 10.iv.1970, *Liswoski, Malaisse & Symoens* 12000 (K).

RWANDA. Kibuye, Gisovu, forêt de Nyungwe, 2250–2400 m, 17.vi.1978, *Raynal* 20620 (BM).

BURUNDI. Route Usumbura–Astrida à 50 km d'Usumburu, 3.i.1948, *Taton* 803 (K).

TANZANIA. Northern: Arusha, Mbulu, Nou Forest, 2250 m, 22.ix.1966, *Carmichael* 1241 (K). Tanga: W. Usambara Mt., near Lushoto, 1260–1650 m, 29.1.1932, *St. Clair-Thompson* 259 (K). Western: Kungwe–Mahali Peninsula, S. of Kungwe, above Kasogi, *c.* 1500 m, 12.ix.1959, *Harley* 9612 (K). Eastern: Uluguru Mts, Banduki, 1200 m, 26.xii.1938, *Vaughan* 2631 (BM). Southern Highlands: Mbeya, Chunya Escarpment, 2340 m, 14.xii.1962, *Richards* 17053 (K).

MALAWI. Northern: Nyika Plateau Valley, *c.* 4 km SW. from Rest House, 2100

Map 2 Sect. 1. *Campylosporus*: 2b. *H. revolutum* subsp. *revolutum*.

m, 22.xi.1958, *Robson & Angus* 246 (BM, K). Central: Dedza, Chongoni Mtn, *c.* 2100 m, 29.v.1960, *Chapman* 722 (BM), 722a (K). Southern: Zomba Plateau, by Chingwe's Hole, 1880 m, 11.ii.1970, *Brummitt & Banda* 8514 (K).

ZAMBIA. Eastern: Nyika Plateau, 1·6 km N. of Rest House, 2100 m, 27.xi.1955, *Lees* 95 (K). [Central: Broken Hill, xi.1928, *van Hogsen* 1231 (PRE), probably wrong location].

ZIMBABWE. Eastern: Umtali, rim of Umkarara Valley, Stapleford Forest Reserve, 1680 m, 16.vii.1955, *Chase* 5676 (BM, K, SRGH).

MOZAMBIQUE. Manica & Sofala: Gorongoza, planalto da serra, 1800 m, 26.ix.1943. *Torre* 5937 (BM).

SWAZILAND. Pigg's Peak, near Havelock, *c.* 1350 m, 16.ix.1960, *Compton* 30123 (K).

[LESOTHO. Occurrence not confirmed. See Jacot-Guillarmod, *Fl. Lesotho*: 212 (1971).]

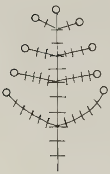
SOUTH AFRICA. Transvaal: Zoutpansberg, *c.* 6·5 km W. of Lake Fundust, 14.vii.1935, *Galpin* 14917 (K, LU). Natal: Zululand, Nkandhla Forest, Pateni Estates, 1200 m, 27.viii.1967, *Strey* 7636 (K). Cape Province: Kokstad, Mt. Malowe, 1350 m, *Tyson* 3044 (K).

CULTIVATED. Specimens seen from England, Scotland, Ireland, and U.S.A. (California), dated 1935–1967, and living material up to 1984.

Except in the areas where it intergrades with subsp. *keniense* (q.v.), subsp. *revolutum* is mostly fairly constant in morphology, varying mainly in leaf venation and style length. In two separate regions, however, relatively broad-leaved forms have evolved. In the Uluguru Mts, eastern Tanzania (e.g. *Bruce* 73 – BM, K), the subspecies tends to have long, elliptic to oblanceolate leaves (23–40 × 6–10 mm; l: b = *c.* 4) with the apex subacute, instead of the usual 10–25 × 2–5 mm (l: b = *c.* 4·5) with the apex acute (on mature shoots). In Eritrea, Ethiopia (e.g. *Pappi* 225 – BM, K), there is a form in which the leaves are short and relatively broad (10–15 × 5–6; l: b = 2–2·5) with the apex apiculate to obtuse.

3. **Hypericum lanceolatum** Lam.

Encycl. méth. (Bot.) **4**: 145 (1797); Choisy, *Prodr. monogr. Hypér.*: 41 (1821), in DC., *Prodr. syst. nat. regni veg.* **1**: 545 (1824); Oliver, *Fl. trop. Afr.* **1**: 156 (1868) pro parte, quoad typum; Engler in *Phys. Math. Abh. K. Akad. Wiss. Berlin* **1891**: 306 (1892) pro parte, quoad typum; R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* **3** (6): 209 (1893), 2nd ed. **21**: 176 (1925) pro parte, quoad pl. ex Réunion; Cordemoy, *Fl. Réunion*: 334 (1895); Good in *J. Bot., Lond.* **65**: 330, t. 582 f. 1 (1927); Perrier in *Fl. Madag. et Comores* **35**: 3 (1951) pro parte, quoad typum et syn. *Campylosporus angustifolius* et pl. ex Comoros et Réunion; Robson in *Kew Bull.* **12**: 444 (1958) pro parte quoad typum, in *Kew Bull.* **33**: 582, map 2 (1979), in Robson & Stevens, *Fl. Mascareignes* 49. Guttif.: 3 (1980). Type: Réunion, La Réunion, Ambaville, 1771, *Commerson* (P-LA!, holotype; LINN-SM!).



Shrub or small tree (0·2–)1–7(–10) m tall, slender, much branched, with branches drooping then ascending. *Stems* yellow-brown when young, soon 2-angled, eventually terete; internodes 2–20(–35) mm long, usually much shorter than leaves; bark red-brown to grey. *Leaves* sessile; lamina 17–50 × 3–10 mm, narrowly lanceolate to ± narrowly elliptic or more rarely elliptic or oblanceolate, acute to rounded, margin plane to ± recurved, base narrowly to broadly cuneate, reflexed-auriculate, paler beneath or concolorous, sometimes ± glaucous, subcoriaceous, lower ones eventually deciduous; venation: (1)3–5 basal or near-basal veins, the laterals branching dichotomously near the base, with numerous parallel or interrupted and ± vestigial secondary veins, without or with 1–10 cross-veins and a loose or ± dense tertiary reticulum; laminar glands in secondary venous system either (i) not interrupted and alternating with ± irregular series of short streaks and lines or (ii) interrupted and wholly streaks or dots; marginal glands pale to dark, dense. *Inflorescence* 1-flowered; pedicel 5–15 mm long; bracts foliar but smaller. *Flowers* (35–)40–70 mm in diam., cyathiform to stellate; buds ovoid, acute. *Sepals* 7–11 × 4–7 mm, imbricate, subequal, erect in bud, ovate to triangular-ovate, acute to rounded, margin entire or ± minutely glandular-ciliolate (especially towards the apex), midrib undifferentiated or obscure; laminar glands linear, numerous; submarginal glands absent or dark; marginal glands absent or dark. *Petals* golden yellow, not flushed red or orange outside, persistent, spreading, 25–38 × 15–25 mm, *c.* 3·5 × sepals, broadly to narrowly obovate, with apiculus small, rounded; margin entire or with minute dark sessile glands or glandular cilia, rarely with a few dark intramarginal dots distal to apiculus; laminar glands linear, scarcely interrupted distally. *Stamen fascicles* persistent, each with 20–25 stamens, longest 15–22(–28) mm long, *c.* 0·6–0·8 × petals, with filaments united for *c.* 1 mm. *Ovary* 5–10 × 3·5–7 mm, ovoid-conic; styles 8–18 mm long, 1·2–3 × ovary, 0·6–0·9 coherent, ascending distally; stigmas subglobose to narrowly capitate. *Capsule* 12–14 × 10–12 mm, ovoid-pyramidal. *Seeds* reddish-

brown, 1·0–1·6 mm long, narrowly cylindric to fusiform, not carinate or winged or with distal expansion, finely linear-reticulate, 2n = ?

In mid-altitude forest, forest clearings and margins, dwarf forest patches, heathland, savannahs, and grassland; (550–)1100–2400 m.

Réunion and the Comoros (Grand Comore). Map 3.

H. lanceolatum comprises two subspecies (Robson, 1979), one (subsp. *angustifolium*) confined to Réunion, the other (subsp. *lanceolatum*) also on Grande Comore.

Map 3 Sect. 1. *Campylosporus*: 3a. *H. lanceolatum* subsp. *angustifolium* ▲, *H. lanceolatum* subsp. *lanceolatum* •, *H. madagascariense* ■.

3a. **H. lanceolatum** subsp. **angustifolium** (Lam.) N. Robson

in *Kew Bull.* **33**: 582 (1979), in Robson & Stevens, *Fl. Mascareignes* 49. Guttif.: 5 t. 1, ff. 4–7 (1980). Type: Réunion, La Réunion, 1771, *Commerson* (P-LA!, holotype; K!, P!, isotypes).

H. angustifolium Lam., *Encycl. Méth.* (Bot.) **4**: 145 (1797); Choisy, *Prodr. monogr. fam. Hypéric.*: 41 (1821), in DC., *Prodr. syst. nat. regni veg.* **1**: 545 (1824); Cordemoy, *Fl. Réunion*: 334 (1895); Good in *J. Bot., Lond.* **65**: 330, t. 582 f. 2 (1927).
Campylosporus angustifolius (Lam.) Spach, *Hist. Nat. Vég.* Phan. **5**: 425 (1836), in *Ann. Sci. Nat.* (Bot.) II, **5**: 363 (1836).
Norysca angustifolia (Lam.) Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856).
H. lanceolatum forma *angustifolium* (Lam.) H. Perrier in *Fl. Madag. et Comores* **135**: 3 (1951).

Icon: Robson & Stevens, *Fl. Mascareignes* 49. Guttif.: t. 1, ff. 4–7 (1980).

Stem internodes 2–6 mm long. *Leaves* 17–32 × 3–6 mm, narrowly lanceolate-elliptic to narrowly lanceolate, acute, margin plane, concolorous or somewhat paler beneath, with 3–5 basal or near-basal veins, without or with 1–2 cross-veins not interrupting the numerous parallel secondary veins or changing their direction. *Pedicel* c. 5 mm long. *Stamen fascicles* 15–18 mm long, *c.* 0·7 × petals. *Styles* 8–10 mm long, *c.* 1·1–1·5 × ovary, 0·6–0·7 coherent. *Seeds* 1·2–1·6 mm long.

In dwarf forest patches, heathland, and rough pasture; 1900–2400 m.

Réunion. Map 3.
REUNION. Plaine des Ramparts, *c.* 1900 m, 10.v.1976, *Coode* 5175 (K); Plaine des Salazes, 2400 m, iv.1957, *Léo* (P).

H. lanceolatum subsp. *angustifolium* is very similar to *H. revolutum* subsp. *keniense*, differing only in the sepals (which are erect in bud) and the smaller number of stamens per fascicle. It intergrades with subsp. *lanceolatum* at altitudes between 1500 and 1900 m, in a similar way to that in which the two subspecies of *H. revolutum* intergrade. For a discussion of the distribution and variation in these species, see Robson (1979).

3b. **H. lanceolatum** subsp. **lanceolatum**

H. penticosia Commerson ex Lam., *Encycl. méth.* (Bot.) **4**: 145 (1797), in synon.
Campylosporus reticulatus Spach, *Hist. nat. vég.* Phan. **5**: 424 (1836), in *Ann. Sci. nat.* (Bot.) II, **5**: 363 (1836), nom. illegit.
Norysca lanceolata (Lam.) Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856).
H. revolutum sensu Robson in *Kew Bull.* **14**: 251 (1960); Bamps in *Fl. Congo etc.* Guttif.: 8 (1970), in *Distr. pl. Afr.* **3**: map 72 (1971) pro parte omnes, quoad pl. ex Comores et Réunion.

Icon: Robson & Stevens, *Fl. Mascareign.* 49. Guttif.: t. 1 ff. 1–3 (1980).

Stem internodes 2–20(–35) mm long. *Leaves* 20–50 × 3–10 mm, narrowly lanceolate or narrowly elliptic to elliptic or oblanceolate, acute to rounded, margin usually ± revolute, discolorous, with (1)3 basal veins, and with 3–10 cross-veins interrupting and often deflecting the secondary veins to form numerous streaks or dots. *Pedicel* 5–15 mm long. *Stamen fascicles* 16–22(–28) mm long, *c.* 0·75 × petals. *Styles* 9–18 mm long, *c.* 1·8–3 × ovary, *c.* 0·8–0·9 coherent. *Seeds* 1–1·2 mm long.

In mid-altitude forest and clearings, and in heathland; 550–1800 m.

Comoros (Grande Comore), Réunion. Map 3.
COMOROS. Grande Comore, 1886, *Humblot* 1581 (BM, P) (N.B. Printed labels of this collection wrongly state 'Angouan').
REUNION. Centier de la Roche Écrite, above St Denis, *c.* 1200 m, 25.xi.1973, *Coode & Badré* 4198 (K); route du Maido, 1500 m, 16.xi.1970, *Friedmann* 567 (P).

H. lanceolatum subsp. *lanceolatum* is more variable than subsp. *angustifolium*, but

can usually be distinguished from it by the large, reticulate-veined leaves with revolute margins, and the longer, more coherent styles.

4. **Hypericum madagascariense** (Spach) Steudel

Nomencl. Bot. 2nd ed, **1**: 788 (1840); Robson in *Kew Bull.* **33**: 583 (1979). Type: Madagascar, Prov. Emerina [Imerina] in montibus meridiem versus *Hilsenberg & Bojer* (P!, holotype; BM!).

Campylosporus madagascariensis Spach, *Hist. nat. vég.* Phan. **5**: 426 (1836), in *Ann. Sci. nat.* (Bot.) II, **5**: 363 (1836).

H. lanceolatum sensu R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* **3** (6) 209 (1893), 2nd ed. **21**: 176 (1925) pro parte, quoad pl. Madagasc.; Perrier, *Fl. Madag. et Comores* **135**: 3 (1951) pro parte, excl. typum et syn. *Campylosporus angustifolius* et pl. ex Comoros et Réunion.

Icon: Perrier, *Fl. Madag. et Comores* **135**: f. I, 1–6.

Shrub 1–3 m tall, 'ericoid', with branches ascending or spreading. *Stems* reddish-brown when young, soon 2-angled, eventually terete; internodes 1·5–10 mm long, shorter than leaves; bark red-brown. *Leaves* sessile; lamina 8–18 × 2–9 mm, narrowly oblong or narrowly elliptic-oblong to broadly elliptic or obovate, obtuse to rounded-apiculate, margin plane or recurved, base cuneate, reflexed-auriculate, paler beneath, not glaucous, subcoriaceous, lower ones eventually deciduous; venation: 1 basal vein, the laterals interrupted by 6–10 cross-veins and reduced to ± short streaks and dots in the areoles of the ± dense tertiary reticulum; laminar glands in secondary venous system, numerous, streaks or dots; marginal glands pale to dark, dense to sparse, or absent. *Inflorescence* 1-flowered; pedicel 2–4 mm long; bracts intermediate in form. *Flowers* 25–35 mm in diam., stellate; buds ovoid, subacute. *Sepals* 7–11 × 2–3 mm, imbricate, subequal, erect in bud but eventually more or less spreading, ovate to triangular-ovate, obtuse to rounded, margin entire or with a few usually glandular cilia towards the apex, midrib ± distinct; laminar glands linear, numerous; submarginal glands dark; marginal glands absent or dark. *Petals* golden yellow, not flushed red or orange outside ?, persistent, spreading or reflexed, 12–20 × 6–9 mm, *c.* 2 × sepals, obovate-oblanceolate, with apiculus small, rounded; margin entire or with minute dark sessile or subsessile glands, with dark intramarginal dots at outer margin; laminar glands linear, scarcely interrupted distally, and occasionally also dark, punctiform. *Stamen fascicles* persistent, each with *c.* 25 stamens, longest 7–10 mm long, *c.* 0·5 × petals, with filaments united at the base. *Ovary* 3–4 × 2·5–3 mm, broadly ovoid; styles 5–6 mm long, *c.* 1·5 × ovary, completely coherent; stigmatic mass capitate. *Capsule* 7–8 × 6–7 mm, broadly ovoid. *Seeds* yellowish-brown, *c.* 1·5 mm long, narrowly cylindric, not carinate or winged or with distal expansion, finely linear-reticulate. 2n = ?

In clearings and damp depressions in montane forest; (1400–)1700–2700 m.

Madagascar (Tsaratanana massif (northern) and Imerina massif (central). Map 3.

MADAGASCAR. Centre (Centre-Nord): Massif du Tsaratanana, plateaux supérieurs et hauts sommets de l'Amboabory a l'Antsianongatalata, 2600–2700 m, xi–xii.1937, *Humbert* 18376 (P). Centre (Centre-Moyen): Prov. Imerina, Massif d'Ankaratra ?, [1822–1823], *Hilsenberg & Bojer* (BM, P).

H. madagascariense was not recognised as distinct from *H. lanceolatum* sensu lato by either Keller or Perrier de la Bâthie, although its completely coherent styles and narrower sepals, smaller flowers and smaller, relatively broader leaves make it easily distinguishable. It appears to be derived from *H. lanceolatum* subsp. *lanceolatum*.

All the recent collections that I have seen have come from the north of the island, and so the species may now be extinct in the centre.

5. **Hypericum balfourii** N. Robson, **sp. nov.**

H. mysurensi Wight et Arnott affinis, sed petalis laterale apiculatis apiculo semper rotundato, staminorum fasciculis tarde deciduis, stylis brevioribus (5–8 mm

longis), ad 1/2 vel 5/6 coalitis, capsulis longioribus (13–15 mm longis), differt. Type: Socotra, Haggiher Mts, ii–iii.1880, *I. B. Balfour* 606 (K!, holotype; A!, BM!, E!).

H. mysorense sensu Balf. f. in *Trans. R. Soc. Edinb.* **31**: 26 (1888); Hutchinson, *Fam. Fl. Pl.*: 186 (1926), 2nd ed. 2: 297 (1959), 3rd ed.: 336 (1973); Good in *J. Bot., Lond.* **65**: 334, t. 582 f. 15 (1927); Robson in *Kew Bull.* **12**: 444 (1958) pro parte omnes, quoad pl. socotranum.

H. mysurense sensu Moggi & Pisacchi in *Webbia* **22**: 260, f. 8, map 5 (1967) pro parte, excl. typum.

H. socotranum sensu Moggi & Pisacchi in *Webbia* **22**: 257 (1967) pro parte, quoad spec. Forbes.

Icon: Moggi & Pisacchi in *Webbia* **22**: 263, f. 8 (1967).

Shrub or tree 0·9–2·1 m tall, with branches spreading or subpendulous (always ?), *Stems* red when young, soon terete; internodes 4–11 mm long, shorter than leaves; bark grey. *Leaves* sessile; lamina 17–40 × 4–12 mm, ± narrowly elliptic or rarely oblanceolate, acute, margin plane, base narrowly cuneate, not or scarcely reflexed-auriculate, concolorous, ± glaucous, subcoriaceous, lower ones soon deciduous; venation: (3)5(7) basal or lower lateral unbranched veins (i.e. midrib + 1–3 pairs), the midrib branched pinnately above, with numerous secondary veins and sometimes a lax tertiary reticulum; laminar glands in secondary venous system, streaks and lines; marginal glands pale, dense. *Inflorescence* 1–3(–10)-flowered, from 1–2 nodes, if from 2 nodes then internode not condensed; pedicels 2–6 mm long; bracts intermediate. *Flowers* 40–75 mm in diam., stellate; buds ovoid-conic, acute to subacute. *Sepals* 6–8 × 3·2–5·5 mm, imbricate, unequal, ovate to oblong, acute to broadly obtuse, margin entire to distally eglandular-denticulate, midrib obscure; laminar glands linear, numerous; submarginal and marginal glands absent. *Petals* golden yellow, unmarked or (?) flushed orange outside, deciduous, spreading, 20–35 × 10–20 mm, broadly to narrowly obovate, with apiculus broad, rounded; margin entire, eglandular; laminar glands linear, interrupted distally. *Stamen fascicles* tardily deciduous, each with 45–70(–80) stamens, longest 8–17 mm long, *c.* 0·3 × petals, with filaments united for *c.* 0·5 mm. *Ovary* 5–6·5 × 3·5–4 mm, ovoid; styles 5–8 mm long, 1–1·2 × ovary, 0·5–0·9 coherent (at least in flower), erect or spreading distally; stigmas capitate or subcapitate. *Capsule* 13–15 – 7–9 mm, ovoid to narrowly ovoid-pyramidal. *Seeds* yellowish-brown, *c.* 1·5 mm long, narrowly cylindric, not winged, slightly carinate, finely linear-foveolate. 2n = ?

On granite slopes and rock crevices; 450–900 m.

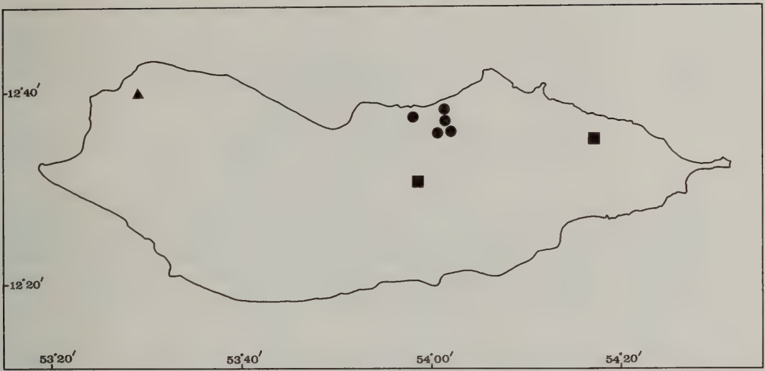
Socotra, central. Map 4.

SOCOTRA. Haggiher Mts, Adho Dhemalu, 810 m, 19.iv.1967, *Smith & Lavranos* 435 (K); Reiged, 450 m, 4.iv.1953, *Popov* SO/359 (BM, EA).

Balfour (1888) included these Socotran plants in *H. mysurense* Wight & Arnott, a species from Sri Lanka and south India and the most primitive member of sect. 3. *Ascyreia*. The relationship between *H. balfourii* and *H. mysurense* is close, and the former is abnormal in sect. *Campylosporus* in having deciduous petals and stamens. Nevertheless, *H. balfourii* can always be distinguished by the shorter, ± united styles, the lateral (not subapical), rounded petal apiculus, the tardily deciduous stamens and the absence of a condensed inflorescence internode, and usually by the more obtuse sepals. The apiculus position and union of the styles clearly indicate that *H. balfourii* should be included in sect. *Campylosporus*, not sect. *Ascyreia*, although the deciduous petals and stamens indicate its intermediate position between these sections.

6. **Hypericum socotranum** Good

in *J. Bot., Lond.* **65**: 334, t. 582 f. 16 (1927); Robson in *Kew Bull.* **12**: 444 (1958); Moggi & Pisacchi in *Webbia* **22**: 257, f. 6, map 4 (1967) pro parte, excl. spec. Forbes. Type: Socotra [Qallansiya ?], on the higher parts of the hills, ii–iii.1880. *I. B. Balfour* 246 (BM!, holotype; E!, K!).



Map 4 Sect. 1. *Campylosporus*: 5. *H. balfourii* ●, 6a. *H. socotranum* subsp. *socotranum* ▲, 6b. *H. socotranum* subsp. *smithii* ■.

Shrub or tree 0·9–4·5 m tall, bushy, with branches ± ascending. *Stems* red when young, soon terete; internodes 4–40 mm long, shorter than to exceeding leaves; bark grey. *Leaves* sessile; lamina 12–30 × 5–22 mm, elliptic to oblanceolate or subcircular, acute to rounded, margin plane, base narrowly to broadly cuneate or subangustate, not reflexed–auriculate, concolorous, ± glaucous, subcoriaceous, lower ones soon deciduous; venation: 1–3(5) basal or lower lateral veins (i.e. midrib + 1–2 pairs), the laterals unbranched or occasionally dichotomising, or the outer ones pinnately branched, the midrib pinnately branched, with vestigial secondary venation and obscure tertiary reticulum; laminar glands in secondary venous system, streaks and lines or dots; marginal glands pale, dense. *Inflorescence* 1–5-flowered, from one node; pedicel 1–11 mm long; bracts foliar but smaller. *Flowers* 40–75 mm in diam., stellate; buds ovoid-conic to ovoid, subacute to obtuse. *Sepals* 4·5–6·5 × 2·5–3 mm, imbricate, unequal, ovate-lanceolate to oblong, apiculate or obtuse to rounded, margin entire, midrib obscure; laminar glands linear numerous; submarginal and marginal glands absent. *Petals* golden yellow, not tinged ?, deciduous, spreading, 15–40 × 9–24 mm, *c.* 3–6 × sepals, broadly obovate, with apiculus broad, rounded; margin entire, eglandular; laminar glands linear, interrupted distally. *Stamen fascicles* tardily deciduous, each with 45–70 stamens, longest 7–12 mm long, 0·3–0.5 × petals, with filaments united for *c.* 0·5 mm. *Ovary* 5–6·5 × 3·5–4 mm, ovoid to ovoid-conic; styles 5–8 mm long, 1–1·2 × ovary, 0·3–0·9 coherent, spreading distally; stigmas capitate or subcapitate. *Capsule* 12–13 × 6–7 mm, ovoid to narrowly ovoid-pyramidal. *Seeds* yellowish-brown, *c.* 1·5 mm long, narrowly cylindric, not winged, slightly carinate, finely linear-foveolate. 2n = ?

On limestone escarpments and rock crevices; 210–600 m.

Socotra, east and west. Map 4.

It has been very difficult to decide on the status of the three taxa comprising the aggregate *H. socotranum*, as there are good reasons for treating them all respectively as species or as subspecies. In the end, the primitive taxon of granite areas in the centre of Socotra has been given specific rank as *H. balfourii*, whereas the other two, growing on limestone at either end of the island, have been treated as subspecies.

6a. **H. socotranum** subsp. **socotranum**

H. lanceolatum sensu Balf. f. in *Trans. R. Soc. Edinb.* **31**: 27 (1888).

Icon: Moggi & Pisacchi in *Webbia* **22**: 259, f. 6 (1967).

Stem internodes 4–16 mm long, shorter than leaves. *Leaves* 12–24 × 5–10 mm, elliptic to oblanceolate, acute or apiculate to obtuse, with 1–3(5) ± basal veins, and gland dots visible on dorsal surface. *Inflorescence* 1-flowered; pedicel 1–6 mm long. *Sepals* 5–6·5 × 2–5·3 mm, apiculate to obtuse. *Petals* 15–30 × 9–15 mm. *Stamen fascicles* 8–12 mm long. *Ovary* ovoid-conic; styles 0·3–0·6 coherent. *Capsule* 12–13 × 6–7 mm.

Socotra, western (Qallansiyah region); 210 m. Map. 4.
SOCOTRA. Qallansiyah, Jebel Ma'ali, above Qaysuh, 210 m, 27.iii.1967, *Smith & Lavranos* 133 (BM, K).

6b. **H. socotranum** subsp. **smithii** N. Robson, **subsp. nov.**

H. socotrano Good affinis, sed pedicellis et plerumque caulis internodis longioribus, foliis latioribus, haud dorsaliter glanduloso-punctata, floribus plerumque numerosioribus, stylis longiore connatis, differt. Type: Socotra. Hammaderoh, Majhah escarpment, 510 m, *Smith & Lavranos* 272 (BM!, holotype; K!).

Icon: —.

Stem internodes 6–40 mm long, often longer than the leaves. *Leaves* 15–30 × 8–22 mm, broadly elliptic to subcircular, apiculate to rounded, with 5(7) ± basal veins, without gland dots visible on dorsal surface. *Inflorescence* 1–5-flowered; pedicel 5–11 mm long. *Sepals* 4·5–6 × 2·5–3 mm, obtuse to rounded. *Petals* 18–40 × 10–24 mm. *Stamen fascicles* 7–11 mm long. *Ovary* ovoid to ovoid-conic; styles 0·5–0·9 coherent. *Capsule* 12 × 6 mm (immature ?).

Socotra, eastern (Hammerdoh); 390–600 m. Map 4.
SOCOTRA. Hammerdoh, Majhah escarpment, 390 m, 8.iv.1967, *Smith & Lavranos* 319 (BM, K); on limestone plateau [Grunhin Plateau] near the upper reaches of the Wadi Zirik, 600 m, 16.v.1967, *Smith & Lavranos* 729 (BM, K).

Smith & Lavranos 729 is described as 'a tree about 15′ [4·5 m] high; much lopped for camel fodder'.

7. **Hypericum quartinianum** A. Rich.

Tent. fl. abyss. **1**: 97 et *Icones*: t. 21 (1847); Oliver, *Fl. trop. Afr.* **1**: 156 (1868) pro parte, excl. syn. Schimper.; Engler in *Phys. Math. Abh. K. Akad. Wiss. Berlin* **1891**: 307 (1892); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* **3** (6): 209 (1893), 2nd ed. **21**: 176 (1925); T. C. E. Fries in *Notizbl. bot. Gart. Mus. Berlin* **8**: 565 (1923); Good in *J. Bot., Lond.* **65**: 332, t.582 f.10 (1927); Dale, *Indig. trees Uganda*: 157 (1952); Milne-Redh. in *Fl. trop. E. Afr.* Hyperic.: 3 (1953); Robson in *Kew Bull.* **12**: 444 (1958), in *Fl. Zamb.* **1**: 380 (1961); Cufod. in *Bull. Jard. bot. État Brux.* **29**, suppl.: 589 (1959); Dale & Greenway, *Kenya trees & shrubs*: 237 (1961); Moggi & Pisacchi in *Webbia* **22**: 252, f. 4, map 3 (1967); Bamps, *Fl. Congo, etc.* Guttif.: 13 (1970), in *Bull. Jard. bot. natn. Belg.* **41**: 443 (1971), in *Distr. pl. Afr.* **3**: map 76 (1971); Agnew, *Upl. Kenya wild fls.*: 186 (1974); Robson in Bamps, Robson & Verdcourt, *Fl. trop. E. Afr.* Guttif.: 29 (1978). Type: Ethiopia, Choa, *Quartin-Dillon & Petit* s.n. (P, holotype; K!).

H. affine Steudel ex Oliver, *Fl. trop. Afr.* **1**: 156 (1868), in synon.

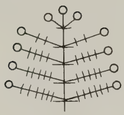
H. ulugurense Engler in *Bot. Jb.* **28**: 434 (1900); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925); Good in *J. Bot. Lond.* **65**: 332, t. 582 f. 11 (1927); Dale, *Indig. trees Uganda*: 157 (1952). Type: Tanzania, Uluguru Mts, *Stuhlmann* 9247 (B†).

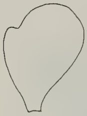
Icones: Moggi & Pisacchi in *Webbia* **22**: 255, f. 5 (1967); Fig. 10.

Shrub or tree 0·5–6 m tall, loosely branched, with branches spreading or ascending. *Stems* red when young, soon terete; internodes 10–26 mm long, shorter than leaves; bark grey. *Leaves* sessile or very shortly petiolate (to 1 mm); lamina (16–)20–90 × 5–27 mm, ovate-lanceolate to oblong-elliptic or oblanceolate, acute to subacute or subapiculate-obtuse, margin plane to recurved, base cuneate to cordate-

Fig. 10 *H. quartinianum*: (a) habit; (b) leaf section; (c) flowering branch; (d) sepal; (e) petal; (f) stamen fascicle; (g) anthers; (h) capsule (a, c × 1; d–f, h × 4; b × 8; g × 20). (a) *Schlieben* 4230; (b–e) *Mendonça* 720; (f–h) *Greathead* 92.

amplexicaul, sometimes subauriculate, paler beneath, not or scarcely glaucous, chartaceous, lower ones eventually deciduous; venation: 5–7(9) basal and lower lateral veins (i.e. midrib + 2–4 pairs), the laterals unbranched, the midrib pinnately branched distally, usually linked by cross-veins, with numerous secondary veins continuous or ± interrupted by ± dense tertiary reticulum; laminar glands in secondary venous system, lines alternating with ± irregular series of small dots and short streaks; marginal glands dark, dense. *Inflorescence* (1)3–9-flowered, from 1(2)





nodes, often with lateral flowering branches; pedicels 10–25 mm long; bracts intermediate. *Flowers* 35–70 mm in diam., stellate; buds ovoid, acute. *Sepals* 5–15 × 2–5 mm, imbricate to basally open, unequal, reflexed in fruit, ovate-lanceolate to triangular-lanceolate, acute, margin glandular-ciliate or -denticulate, midrib undifferentiated; laminar glands linear, numerous; submarginal and marginal glands dark. *Petals* golden yellow to lemon-yellow, not tinged, tardily deciduous, spreading to reflexed, (17–)20–41 × 10–25 mm, 2–3 × sepals, obovate, with apiculus obtuse; external margin with few sessile or intramarginal dark reddish glands, internal margin dark-glandular-ciliate; laminar glands linear, not interrupted. *Stamen fascicles* tardily deciduous, each with *c.* 30 stamens, longest 15–22(–25) mm long, 0·5–0·75 × petals, with filaments very shortly united. *Ovary* 5–8 × 3–5 mm, rather broadly to narrowly ovoid; styles 8–13 mm long, 1·2–1·6 × ovary, completely or almost completely coherent; stigma mass capitate or subcapitate. *Capsule* 10–16 × 5–10 mm, broadly to narrowly ovoid. *Seeds* yellow-brown, *c.* 1 mm long, cylindric, not winged, slightly carinate, shallowly linear-reticulate. 2n = ?

In rocky places, gulleys, and river banks in upland grassland or deciduous woodland; 1150–3300 m.

Yemen, Ethiopia, Sudan Republic (south), Kenya (Mt. Elgon), Uganda (Mt. Elgon, Karamoja), Tanzania (southern), Zaïre (Shaba), Malawi (Misuku, Nyika, Vipya), Zambia (Mbala, Serenje), Mozambique (Lago). Map 5.

YEMEN. Jebel Raymah above Hadia, on NW. of Jebel Thallamlam, near Na'ama, *c.* 1800 m, i.vi.1979, *Wood* 2817 (BM).

SUDAN REPUBLIC. Equatoria [El Istwaya]: Torit, near Moimoi Dongotonas, 1800 m, 21.i.1950, *Jackson* 1096 (BM).

ETHIOPIA. Tigray: Djenda, Demben, 30.iii.1872, *Steudner* 1439 (K). Gonder: near Gondar 3000 m, 25.5.1958, *Greathead* 92 (BM, EA, K). Gojam: Chamoga valley, S.S.E. of Debre Marcos, 2500 m, 31.i.1960, *Kuls* 144 (FR). Shoa: Chellamo forest, 72 km W. of Addis Ababa, 2700 m, 8.xii.1953, *Mooney* 5087 (K). Wellega: Hupé, 1950 m, 22.ii.1957, *Mooney* 6785 (K.). Keffa: 8 km S. of Jimma on Bonga road, 1760 m, 23.xii.1961, *Meyer* 7794 (K). Gamo Gofa: Uva range, 19 km E. of Bulki, W. slope, 1500 m ?, 13.iv.1949, *Thesiger* 1809 (BM). Sidamo: hill to SW. of Agheremariam (also to E.), 2070 m, 3.xii.1952, *Gillett* 14601 (K). Arssi: W. shore of L. Zouai, i.1899, *Welby* (K). Harerghe: between Herna and Asbe Tefari, ± 2100 m, 22.xii.1962, *Burger* 2455 (K).

KENYA. Rift Valley: Trans-Nzoia, SW. Elgon, 2010 m, 11.iii.1958, *Symes* 301 (K).

UGANDA. Northern: Karamoja, Napak, 2100 m, ii.1938, *Sangster* 418 (K). Eastern: Mt. Elgon, Sipi, 1950 m, ix.1934, *Synge* 1078 (BM).

ZAIRE. Shaba: Kasenia, falls of the Mulamba, ix.1962, *Schmitz* 7838 (K).

TANZANIA. Western: Ufipa, above Milepa, L. Rukwa north, 1800–2100 m, 3.x.1936, *Michelmore* 742 (K). Eastern: Morogoro, Bundiki, *c.* 1350 m, 17.viii.1951, *Greenway & Eggeling* 8596 (K). Southern Highlands; Mbeya, foot of Wenzel Hekmann Crater [L. Ngozi], 1650 m, 28.viii.1936, *Burtt* 6233 (BM, K). Southern: Songea, Matengo Hills, *c.* 8 km N. of Miyau, 1570 m, 21.v. 1956, *Milne-Redhead & Taylor* 10406 (K).

MALAWI. Northern: Chitipa, Misuku Hills, Walindi Forest, 2000 m, 12.xi.1958, *Robson* 583 (K); Vipya Plateau, near Mzuzu, 1200 m, 25.ix.1966, *Pawek* 109 (MAL).

ZAMBIA. Northern: Serenje, Kundalila Falls, 13.x.1963, *Robinson* 5697 (K).

MOZAMBIQUE. Niassa: Lago, Maniamba, rio Lualeze, 1200 m, 10.x.1942, *Mendonça* 720 (BM, LISC).

Plants of *H. quartinianum* from the northern part of its range (Yemen, Ethiopia, Kenya, Uganda) tend to have smaller, narrower, cuneate-based leaves with poorly developed reticulate venation, and small flowers, whereas those from the southern part (Tanzania, Mozambique, Malawi, Zambia, Zaïre) tend to have larger, broader, cordate-based leaves with relatively well-developed reticulate venation, and larger flowers. The correlation of these various trends is incomplete, however, so that the southern form cannot be distinguished as *H. ulugurense*.

Map 5 Sect. 1. *Campylosporus*: 7. *H. quartinianum* ●, 8. *H. synstylum* ▲.

8. **Hypericum synstylum** N. Robson

in *Kew Bull.* **12**: 433 (1958); Moggi & Pisacchi in *Webbia* **22**: 259, f. 7, map 4 (1967).
Type: Somalia, Gan Libah, Golis Range, Hrialajat, 9.vii.1945, *Glover & Gilliland* 1168 (K! holotype; BM!, EA).

Icon: Moggi & Pisacchi in *Webbia* **22**: 261, f. 7 (1967).

Shrub 1·5–3 m tall, diffusely branched, with branches spreading. *Stems* orange when young, soon terete; internodes 6–11 mm long, shorter than leaves; bark reddish-brown. *Leaves* with petiole 1–2 mm long; lamina 10–30 × 5–12 mm, oblong or elliptic-oblong to ovate, apiculate-obtuse to rounded, margin plane, subincrassate, base broadly cuneate to rounded, not auriculate, paler beneath, scarcely glaucous, chartaceous, lower ones soon deciduous; venation: 7–9 basal and lower lateral veins (i.e. midrib + 3–4 pairs), the laterals unbranched, linked by cross-veins, with secondaries reduced to short streaks in areolae of lax tertiary reticulum; laminar glands in secondary venous system, short streaks, without distinct alternating series of dots; marginal glands reddish or pale, irregular. *Inflorescence* 1–2-flowered; pedicel up to 2·5 mm long; bracts intermediate, acute. *Flowers* 25–33 mm in diam., stellate; buds ovoid, acute. *Sepals* 5–7 × 1·7–2·2 mm, scarcely imbricate to basally open, equal, linear-lanceolate, acute, margin entire, midrib obscure; laminar glands linear to punctiform, numerous; submarginal glands absent; marginal glands pale or absent. *Petals* golden yellow, not tinged, tardily deciduous, spreading, 13–16 × 8–10 mm, *c.* 2·5 × sepals, obovate, with apiculus very small or absent; margin entire, eglandular; laminar glands linear, not interrupted. *Stamen fascicles* persistent, each with 15–20 stamens, longest 7–10 mm long, 0·5–0·75 × petals, with filaments united for *c.* 0·5 mm. *Ovary* 5–6·5 × 2–3 mm, narrowly ovoid; styles 6–7 mm long, 1·1–1·2 × ovary, completely coherent; stigma mass narrow, not capitate. *Capsule* 8–10 × 5–6 mm, narrowly ovoid. *Seeds* reddish-brown, 1·2–1·5 mm long, cylindric, not winged or carinate, shallowly linear-reticulate. 2n = ?

In limestone rocks on black soil, *c.* 2100 m.

Ethiopia (Harerghe [Harar]), Somalia (North). Map 5.

ETHIOPIA. Harerghe: Mt. Achim, 2100 m, 14.x.1954, *Bally* 10057 (K); road to Combulcha and Harar, W. of Ejersa-Goro (9°28′N, 42°12′E), ± 2100 m, 2.xi.1963, *Burger* 3320 (K).

SOMALIA. North: Golis Range, Ga'an Libah Forest Reserve, 2.ii.1973, *Bally & Melville* 16232 (EA), 16233 (K).

H. synstylum is clearly intermediate in many respects between *H. quartinianum* and the primitive members of the N. American sect. 20. *Myriandra*. Thus, where it differs from *H. quartinianum* (e.g. in the absence of dark glands and the entire sepals and petals), it approaches *H. frondosum*. It is apparently confined to two disjunct areas *c.* 300 km apart.

9. **Hypericum roeperianum** W. G. Schimper ex A. Rich.

Tent. fl. Abyss. **1**: 96 (1847); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* **3** (6): 20 (1893), 2nd ed. **21**: 176 (1925); Good in *J. Bot., Lond.* **65**: 331, t. 582 f. 6 (1927); Exell & Mendonça, *Consp. fl. Angol.* **1**: 119 (1937), 369 (1951); Bredell in *Bothalia* **3**: 582, t. 1 f. 11, map (1939); Brenan, *Checkl. Tang. Terr.* **2**: 250 (1949); Milne-Redh., *Fl. trop. E. Afr.* Hyperic.: 3 (1951); Dale, *Indig. trees Uganda*: 159 (1952); Robson in *Kew Bull.* **12**: 444 (1958), in *Fl. Zamb.* **1**: 380 (1961); Cufod. in *Bull. Jard. bot. État Brux.* **29**, suppl.: 589 (1959); Dale & Greenway, *Kenya trees & shrubs*: 237 (1961); Spirlet, *Contr. fl. Congo* Guttif.: 8 (1966); Moggi & Pisacchi in *Webbia* **22**: 244, f. 2, map (1967) pro parte, excl. subsp. *gnidiifolium*; Bamps, *Fl. Congo, etc.* Guttif.: 12 (1970), in *Bull. Jard. bot. natn. Belg.* **41**: 441 (1971), in *Distr. pl. Afr.* **3**: map 75 (1971); Agnew, *Upl. Kenya wild fls.*: 186 (1974); Killick & Robson in *Fl. Sthn Africa* **22**: 16 (1976); Robson in Bamps, Robson & Verdcourt, *Fl. trop. E. Afr.* Guttif.: 29 (1978). Types: Ethiopia, [Gonder] prope Dschenausa ad montem Aber, 4.i.1840, *Schimper* 866 (P, lectotype – Moggi & Pisacchi (1967); FI; G; K! LE; MO) (the K specimen is annotated 'prov. Semien Jul. 1843' in ms.); [Tigray] ad montem Kubbi prope Adoam, i., *Schimper* (n.v.).

H. schimperi Hochst. [in *Flora, Jena* **24** (1): 29 (1841)] ex A. Rich., *Tent. fl. Abyss.* **1**: 97 (1847); Oliver, *Fl. trop. Afr.* **1**: 150 (1868); Engler in *Phys. Math. Abh. K. Akad. Wiss. Berlin* **1891**: 307 (1892); R. Keller in Engler & Prantl, *Nat. Pflanzen-*

fam. 2nd ed. **21**: 176, f. 73V, W (1925); Good in *J. Bot., Lond.* **65**: 331, t.582 f. 7 (1927); Dale, *Trees & shrubs Kenya*: 36 (1936); Cufod. in *Bull. Jard. bot. État Brux.* **29**, suppl.: 589 (1959). Types: Ethiopia, [Tigray] Ad rupes . . . montis Kubbi proxime ad ecclesiam 'Arba tensa' (in regione Memsach), 29.xii.1837, *Schimper* 132 (P, lectotype;* G; K!; L; LE; M; PAL; W!); Abyssinia, 1842, *Schimper* 1160 (FI; G; K!; L; LE; M; P; UPS; W!); [Gonder] in provincia Ouodgerate in sylvis Goumasso, *Q.-Dillon & Petit* (K!; P).

H. quartinianum sensu Oliver, *Fl. trop. Afr.* **1**: 156 (1868) pro parte, quoad spec. Schimper.; De Wild. in *Contr. fl. Katanga*: 132 (1921); T. C. E. Fries in *Notizbl. Bot. Gart. Mus. Berlin* **8**: 565 (1923) pro parte, excl. typum.

H. schimperi var. γ sensu Oliver, *Fl. trop. Afr.* **1**: 157 (1868).

H. quartinianum var. *roeperianum* (W. G. Schimper ex A. Rich.) Engler in *Phys. Math. Abh. K. Akad. Wiss. Berlin* **1891**: 307 (1892); Pichi-Sermolli, *Miss. Stud. Lago Tana* (Bot.) **1**: 97 (1951).

H. schimperi var. *angustisepalum* Engler in *Phys. Math. Abh. K. Akad. Wiss. Berlin* 1891: 307 (1892). Type: Angola, Huilla, *Welwitsch* (B†, holotype) (same collection as type of var. *huillense*).

H. schimperi var. *huillense* Hiern, *Cat. Afr. pl. Welw.* **1**: 56 (1896). Type. Angola, Huilla, Morro de Lopolo, 23.v.1860, *Welwitsch* 1055 (BM!, holotype; B†; COI; K!; LISU).

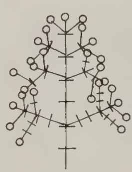
H. riparium A. Chev. in *Bull. Soc. Fr.* **54** (8): 8 (1907), *Expl. Bot. Afr. Occ. Franc.* **1**: 49 (1920); Good in *J. Bot., Lond.* **65**: 331 (1927); Keay & Milne-Redh. in *Fl. W. trop. Afr.* 2nd ed. **1**: 287 (1954); Pellegrin in *Bull. Soc. bot. Fr.* **106**: 217 (1959). Type: guinée, Diagiussa, iv.1905, *Chevalier* 13460 (P, holotype; K!).

H. conrauanum Engler in *Bot. Jb.* **40**: 555 (1908); Good in *J. Bot., Lond.* **65**: 332, t. 582 f. 9 (1927). Type: Cameroon, Baberong, 1470 m, i.iv.1898, *Conrau* 28 (B†, holotype; BM!; E!).

H. roeperanum var. *schimperi* (Hochst. ex A. Rich.) Moggi & Pisacchi in *Webbia* **22**: 249 (1967).

Icon: Moggi & Pisacchi in *Webbia* **22**: 248, f. 2 and 251, f. 3 (1967).

Shrub or tree 0·6–5 m tall, bushy, with branches ascending. *Stems* red when young, soon 2-lined to terete; internodes 10–30 mm long, shorter than leaves; bark reddish-brown. *Leaves* sessile; lamina (25–)30–100(–115) × (5–)10–40 mm, lanceolate or occasionally ovate to elliptic or oblong-elliptic, acute to obtuse, margin recurved to revolute, base cuneate, sometimes subauriculate, paler beneath, sometimes glaucous, chartaceous to subcoriaceous, lower ones ± persistent; venation: 7(9) basal and lower lateral veins (i.e. midrib + 3(4) pairs), the laterals and midrib branches forming dense tertiary reticulum, with secondaries reduced to dots in areolae; laminar glands in secondary venous system, dots (sometimes elongate), without distinct alternating series; marginal glands dark, dense. *Inflorescence* (1)3–∞-flowered, from 1–2(–4) nodes, often with lateral flowering branches; pedicel 5–20 mm long; bracts foliar or intermediate. *Flowers* 30–55 mm in diam., stellate; buds ovoid, acute. *Sepals* (2·5–)5–8 × (1·5–)3·5–5 mm, imbricate, unequal or unequal, ovate-lanceolate to ovate, acute to obtuse, margin subentire to glandular-ciliate or -denticulate, midrib undifferentiated; laminar glands linear, numerous; submarginal and marginal glands dark. *Petals* golden or bright yellow, sometimes tinged reddish, persistent, spreading to reflexed, (12–)20–35 × (7–)10–20 mm, 3–4 sepals, obovate, with apiculus small, rounded; margin entire, eglandular, or with submarginal to marginal dark glands or dark-glandular-ciliate; laminar glands linear, not interrupted, occasionally also a few dark dots or short streaks. *Stamen fascicles* persistent, each with *c.* 35–45 stamens, longest 10–20 mm long, 0·5–0·65 × petals, with filaments very shortly united. *Ovary* 4–7 × 3–5·5 mm, ovoid to subglobose; styles 8–12 mm long, 1·6–2·3(–3) × ovary, completely coherent or rarely almost so; stigma mass capitate. *Capsule* 9–14 × 7–10 mm, broadly to narrowly ovoid. *Seeds* yellow-brown,



* Moggi & Pisacchi chose the Petit specimen as lectotype; but their choice is unacceptable because Richard validated Hochstetter's name, thereby indicating one of Schimper's specimens as the lectotype. As Hochstetter cited only *Schimper* 132 (the one specimen collected by 1841), I select this as the new lectotype.

c. 1 mm long, cylindric to narrowly pyriform, not winged or carinate, shallowly linear-reticulate. 2n = ?

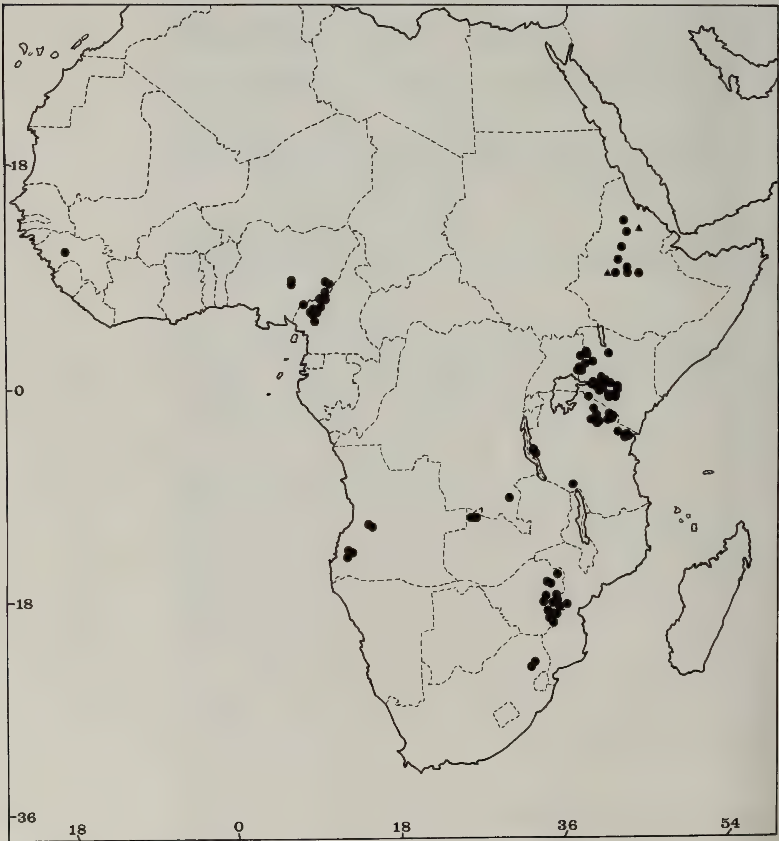
Dry evergreen forest margins, bushland or grassland, or beside rivers or streams; 840–3300 m.

From Ethiopia to the Transvaal, Zambia, and Angola; also in Guinée, Nigeria, and Cameroon. Map 6.

GUINEE. [Fouta Djalon] Diagiussa, cascade du Ditinn, 840 m, iv.1905, *Chevalier* 13460 (K).

NIGERIA. North: Plateau Prov., Jos Distr., Sha, 1350 m i.1960, *Wimbush* 65 (K). East: Ogoja Prov., Obudu Div., Ikwette, 1560 m, 29.xii.1948, *Savory & Keay* FHI 25219 (K); Vogel Peak massif, 1340 m, 13.xii.1957, *Hepper* 1595 (K).

CAMEROON. West: above Bamenda, 2400 m, 18.i.1928, *Migeod* 333 (BM, K); 6



Map 6 Sect. 1. *Campylosporus*: 9. *H. roeperianum* ●, 10. *H. gnidiifolium* ▲.

km N.N.E. Nkambe, près village Gépka (Ntumbe), 1600 m, xi.1974, *Satabie* 80 (K). East: Bamboutos Mts, Djuttitsa, 20.v.1966, *Meurillon* C.N.A.D. 355 (K).

ETHIOPIA. Tigray: Addi Rasa bei Axum, 2021 m, 5.i.1863, *Schimper* 782 (BM). Gonder: Monte Jesus Tabor, 22.iii.1937, *Pichi Sermolli* 186 (K). Welo: Lalibela, 2840 m, 7.i.1924, *Harlan* (US n.v.). Gojam: Choké Mts, W. side of upper Godeb gorge, *c.* 2700 m, 30.viii.1957, *Flenley & Hiller* 266a (K). Shoa: Blue Nile road *c.* 100 km N. of Addis Ababa, between Fiché and Debre Libanos, ± 2000 m, 25.iv.1966, *de Wilde* 10875 (K).

KENYA. Northern Frontier: Mt. Nyiru above Tum, 1800–2100 m, vii.1960, *Kerfoot* 1934 (K). Turkana: Turkana distr., Karasuk, S.E. ridge of Kachagalau Hill, 2650 m, 22.iv.1959, *Osmaston* 4457 (K). Rift Valley: Laikipia distr., above Thomson's Falls, 2325 m, *Verdcourt* 3814 (K). Central: North Nyeri distr., N. of Nanyuki, 8.vii.1938, *Pole Evans & Erens* 1214 (E, K). Masai: Narok, Usso Nyiro, 1800 m, 23.viii.1960, *Paulo* 704 (K).

UGANDA. Northern: Karamoja distr., Napak Mts, 2250 m, vi.1950, *Eggeling* 5912 (K). Eastern: Mbale distr., Mt. Elgon, 2400 m, i.1918, *Dummer* 3602 (K).

ZAIRE. Shaba: 42 km W. of Kabiashia, 1090 m, 31.viii.1966, *Malaisse* 4561 (K).

TANZANIA. Northern: Masai distr., Ngorongoro Conserv. Area, Endulen to Ngorongoro, S. slopes of Mt. Satiman, 2350–2730 m, 18.ix.1977, *Raynal* 19131 (BM, P). Tanga: Lushoto distr., Mlalo, Kilangwi forest, viii.1955, *Semsei* 2286 (K). Western: Mpanda distr., Mahali Mts, Kasieha, 960 m, 26.ix.1958, *Newbould & Jefford* 2698 (K). Southern Highlands: Rungwe distr., Kyimbila, 1350 m, 1909, *Stolz* 221 (LU).

ZAMBIA. Western: Mwinilunga distr., R. Matonchi below dam, 21.x.1937, *Milne-Redhead* 2880 (K, PRE).

ANGOLA. Benguela: R. Guito near Quipeio, *c.* 1500 m, 2.v.1937, *Exell & Mendonça* 1883 (BM). Huila: Sa da Bandeira, Serra de Chella, 10.vii.1967, *Henriques & Brites* 1116 (BM).

ZIMBABWE. Central: Makoni, 1440 m, vi.1917, *Eyles* 795 (BM, K, SRGH). Eastern: Umtali distr., Stapleford Forest Reserve, heights above Inyamakarara Valley, 1680 m, 28.xi.1955, *Chase* 5890 (BM, PRE, SRGH).

MOZAMBIQUE. Manica e Sofala: Manica, Macequece, caseata de Penha Longa, 6.vi.1948, *Mendonça* 4524 (BM, LISC).

SOUTH AFRICA. Transvaal: Pilgrim's Rest distr., Mariepskop area, *c.* 900 m, 18.xi.1958, *Killick & Strey* 2424 (K).

H. roeperianum is closely related to *H. quartinianum*; it has leaf-venation, inflorescence and other characters that are similar but more specialised. Of its 7–8 disjunct areas, two (Guinée and Nigeria/Cameroun) have plants with relatively broad leaves; but the variation is not disjunct between these and the eastern population, so that *H. riparium* cannot be recognised as distinct.

In Ethiopia, Uganda, and Kenya there are two forms, which intergrade morphologically and are not geographically or ecologically distinct. One (*H. roeperianum* sensu stricto) has leaves elliptic to lanceolate, acute, slightly discolorous, the venation densely reticulate, not prominent, with small punctiform areolar glands, and sepals ovate-lanceolate; the other (*H. schimperi*) has leaves oblong or oblong-lanceolate, acute to obtuse, markedly discolorous, with laxer venation prominent beneath and larger slightly elongate areolar glands, and sepals ovate. These forms have been recognised as varieties by Moggi & Pisacchi, but the intermediate forms (e.g. *Scott Elliot* 6569 (BM, K), from Kenya, Gilgit) precluse the recognition of *H. schimperi* even as a variety.

10. **Hypericum gnidiifolium** A. Rich.

Tent. pl. Abyss. **1**: 98 (1847) (*'gnidiaefolium'*); Oliver, *Fl. trop. Afr.* **1**: 157 (1868); Engler in *Phys. Math. Abh. K. Akad. Wiss. Berlin* **1891**: 307 (1892); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* **3** (6): 209 (1893), op. cit. 2nd ed. **21**: 176 (1925); Good in *J. Bot., Lond.* **65**: 332, t. 582 f. 8 (1927); Robson in *Kew Bull.* **12**: 444 (1958), **33**: 582, ff. IC5, 2J, K (1979); Cufod. in *Bull. Jard. bot. État Brux.* **29**, suppl.: 599 (1959). Types: Ethiopia, [Tigray] 'Ouadgerate, altit. 8500 and 9500

pedum ad rivulos,' *Quartin-Dillon & Petit* s.n. (P, lectotype; K!). Moggi & Pisacchi (1967) point out that, of the five *Q.-Dillon & Petit* specimens in Paris (P), three are labelled 'Ouadgerate' or 'Ouedgerate'. Of these, they selected that cited above as lectotype.

H. roeperanum subsp. *gnidiifolium* (A. Rich.) Moggi & Pisacchi in *Webbia* **22**: 250, f. 4 (1967).

Icon: Moggi & Pisacchi in *Webbia* **22**: 253, f. 4 (1967).

Shrub (?) or tree to 4·5 m tall, much branched, with branches ascending. *Stems* yellow-brown when young, soon 2-lined to terete; internodes 6–10 mm long, shorter than leaves; bark reddish-brown. *Leaves* sessile; lamina 17–28 × 4–10 mm, narrowly elliptic to oblong-elliptic, acute to subapiculate, margin plane, subincrassate, base cuneate, not or scarcely auriculate, paler beneath, not glaucous, chartaceous, lower ones gradually deciduous; venation: 3–5(7) basal or lower lateral veins (i.e. midrib + 1–2(3) pairs), the laterals and midrib branches forming rather dense tertiary reticulum, with secondaries reduced to short streaks in areolae; laminar glands in secondary venous system, short streaks, without alternating series of dots; marginal glands pale and dark, dense. *Inflorescence* (1)3–5-flowered, from 1–2 nodes, without lateral flowering branches; pedicels 6–15 mm long; bracts foliar or intermediate. *Flowers c.* 35 mm in diam., stellate; buds ovoid, obtuse. *Sepals* 6–7 × 3·5–5 mm, imbricate, subequal, broadly elliptic or ovate-elliptic to oblong, acute to obtuse, margin entire to glandular-ciliolate, midrib undifferentiated; laminar glands linear, numerous, submarginal glands dark or absent; marginal glands absent or reddish. *Petals* golden yellow, tinged red, persistent, spreading to reflexed, 16–20(–25) × 8–9 mm, 2.5–3 × sepals, obovate-oblanceolate, with apiculus almost absent, rounded; margin internally dark-glandular-ciliate; laminar glands linear, not interrupted. *Stamen fascicles* 'subpersistent', each with *c.* 20 stamens, longest 8–14 mm long, 0·5–0·65 × petals, with filaments united for *c.* 0·5 mm. *Ovary* 5–6 × 3·5–4 mm, broadly ovoid; styles 11–13 mm long, *c.* 2·2 × ovary, *c.* 0·7 coherent; stigmas small, rounded. *Capsule* 7–8 × 6 mm, broadly ovoid-pyramidal. *Seeds* unknown. 2n = ?

Banks of streams: 2700–2900 m.

Ethiopia (Tigray, Shoa). Map 6.
ETHIOPIA. Tigray: Wogera, Maye-Borhha plateau, 2500–2700 m, *Quartin-Dillon & Petit* (K). Shoa: Shoa, *Quartin-Dillon & Petit* (K).

Like *H. roeperianum*, *H. gnidiifolium* has leaves with densely reticulate venation and a 1–several-flowered inflorescence, and occurs within the same area in Ethiopia. As the leaves and flowers are relatively small, it thus appears at first glance to be a reduced form of *H. roeperianum*. Nevertheless, it has some characters that seem to be more primitive (elongate laminar leaf-glands, mixed pale and dark marginal leaf-glands, marginal sepal-glands absent or reddish, styles only partially united), all of which suggest that *H. gnidiifolium* is specifically distinct from *H. roeperianum*. I have seen no recent collections of this species.

Sect. 2. **PSOROPHYTUM** (Spach) Nyman

Consp. Fl. Eur.: 132 (1878).

Shrub up to 1·5 m tall, evergreen, glabrous, without dark glands; branching lateral or rarely pseudo-dichotomous. *Stems* 4-lined, not compressed when young or becoming terete, verrucose-glandular; cortex exfoliating in short flakes; bark scaly. *Leaves* opposite, decussate, sessile, free, deciduous at basal articulation; lamina entire, with venation pinnate, closed, the tertiary obscure; laminar glands punctiform, pale; marginal gland dots pale; ventral glands absent. *Inflorescence* 1-flowered; bracts foliar; bracteoles sepaline, involucral. *Flowers* stellate, homostylous. *Sepals* 5, free, persistent, spreading to reflexed in fruit, with margin entire to denticulate; veins numerous; laminar glands pale, linear, interrupted distally, sometimes also punctiform; submarginal and marginal glands pale. *Petals* 5, deciduous, without or with very shallow lateral apiculus, margin entire; marginal glands absent; laminar glands numerous, pale, linear,

sometimes interrupted distally. *Stamen fascicles* 5, free, deciduous, each with 18–25 stamens; filaments united very shortly; anther gland amber. *Ovary* with 5(4) incompletely axile placentae (united at the base, free but deeply intrusive above), each ∞-ovulate; styles 5(4), free; stigma small. *Capsule* 5(4)-valved, coriaceous, longitudinally vittate. *Seeds* cylindric, not carinate, without apical wing expansion; testa linear-reticulate.

BASIC CHROMOSOME NUMBER (x): 12; ploidy 2.

HABITAT: open dry woods and rocky places, 30–1200 m.

DISTRIBUTION: Balearic Is.

1 species.

1(11). **Hypericum balearicum** L.

Sp. pl.: 783 (1753); Curtis, *Bot. Mag.* **4**: t. 137 (1791); Choisy, *Prodr. monogr. fam. Hypéric.*: 43 (1821), in DC., *Prodr. syst. nat. regni veg.* **1**: 546 (1824); Treviranus, *Hyper. animad.*: 8 (1861); Marès & Vigineix, *Cat. rais. pl. vasc. Iles Baléares*: 61 (1880); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* **3** (6): 211 (1893), 2nd ed. **21**: 177 (1925); Fiori & Paoletti, *Fl. anal. d'Italia* **1**: 384 (1898), *Icon. fl. ital.*: t. 1248 (1898); Knoche, *Fl. Balearica* **2**: 184, maps (1922); Fiori & Paoletti, *Nuovo fl. d'Italia* **1**: 520 (1924); Stefanoff in *God. Agr.-les. Fak. Univ. Sofiya* **11**: 143 (1933), in *Pflanzenareale* **4**: Karte 2a (1933); N. Robson in *Fl. europaea* **2**: 263 (1968); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 408 (1973); Barceló, *Fl. Mallorca* **3**: 173, f. 987 (1979). Types: Balearic Is., Majorca, Herb. Linn. 943/1 (LINN!, lectotype-mihi); also citations from Hort. Cliff., van Royen, Magnol and Clusius. The Herb. Linn. specimen is chosen in preference to that in Herb. Cliff. on account of the new diagnosis provided in *Sp. pl.*: *Hypericum* floribus pentagynis, caule fruticoso, foliis ramisque cicatrisatis.

H. verrucosum Salisb., *Prod. stirp. horto Chapel Allerton*: 369 (1798), nom. superfl. Type as for *H. balearicum* L.
Psorophytum undulatum Spach, *Hist. nat. veg.* Phan. **5**: 413 (1836), in *Annls Sci. nat.* (Bot.) II, **5**: 360 (1836), nom. superfl. Type as for *Hypericum balearicum* L.
H. balearicum var. *ochroleucum* R. A. W. Herm in Knoche, *Fl. Balearica* **2**: 184 (1922), nomen.
Psorophytum balearicum (L.) Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 22 (1951).

Icones: Barceló, *Fl. Mallorca* **3**: 176–177, f. 987 (coloured and b. & w. photos) (1979); Fig. 11.

Shrub or small tree 0·6–2 m tall, usually forming rounded bushes, with branches erect to ascending, sometimes branching pseudo-dichotomously. *Stems* yellow-green when young, glandular-verrucose, especially along the (4) stem lines, terete after first season; internodes 2–10 mm long, shorter than leaves; bark reddish-brown. *Leaves* sessile; lamina (6–)8–15 × 3–7 mm, ovate to oblong-elliptic or narrowly oblong, rounded, margin ± undulate, base broadly cuneate to rounded, paler beneath, not glaucous, coriaceous, lower ones gradually deciduous; venation: 1 basal vein (midrib), 1 pair of main laterals (intramarginal vein) and *c.* 5 subsidiary laterals (cross veins) joining intramarginal vein, with or apparently without obscure tertiary reticulum; laminar glands large, vesicular, prominent, amber, often interspersed with ± numerous small pale dots (beneath); marginal glands dense. *Inflorescence* 1-flowered; pedicel 3–11 mm long; bracts sepaline, involucral. *Flowers* 15–40 mm in diam., stellate; buds ovoid-subglobose, obtuse to rounded. *Sepals* 5–7 × 2–5 mm, imbricate, ± unequal, erect in bud, ± reflexed in fruit, rounded, margin entire to apically denticulate, midrib undifferentiated or obscure; laminar glands linear, interrupted distally, numerous, sometimes also 1–4 large amber vesicular; marginal glands absent. *Petals* golden yellow or very rarely pale yellow, slightly red-tinged outside, deciduous, spreading, 10–20 × 4–9 mm, 2–3 × sepals, narrowly obovate to oblanceolate, with apiculus very small, rounded or absent; margin entire; laminar glands linear, sometimes interrupted distally. *Stamen fascicles* deciduous, each with

Fig. 11 *H. balearicum*: (a) habit; (b) leaf section; (c) flower bud; (d) flower; (e) sepal; (f) petal; (g) stamen fascicle; (h) anthers; (i) capsule (a × 1; c × 2; d, i × 4; f, g, × 6; e × 8; b × 12; h × 20). (a, b, d, i) *J. & M. Cannon* 3804; (c) *Maude* s.n.; (e–h) *Auquier et al.* 7614.

18–25 stamens, longest 8–18 mm long, *c.* 0·8 × petals, with filaments very shortly united. *Ovary* 3–5 × 2–3 mm, narrowly ovoid-conic; styles 6–13 mm long, 2–2·5 × ovary, suberect or slightly outcurved distally; stigmas small. *Capsule* 8–12 × 5–7 mm, narrowly ovoid to ovoid-pyramidal. *Seeds* reddish-brown, *c.* 1·7 mm long, cylindric, not carinate or winged, finely linear-reticulate. 2n = 24.

Dry woods and calcareous rocky or stony places; 30–1200 m.

Balearic Islands (Mallorca, Menorca, Ibiza, Cabrera, Dragonera). Map 7.
MALLORCA. Soller distr., Soller side of pass to Lluch, 2.vi.1954, *J. & M. Cannon* 2648 (BM); Pollensa distr., Cala San Vicente, track to western headland, 10.iv.1971, *J. & M. Cannon* 3804 (BM); Palma distr., Genova, près Palma, 19.iv.1919, *Sauvan-Denis* in *Sennen* 3668 (BM, K).
MENORCA. Alayor, Son Blanc, 20.vi.1876, *Rodriguez* (K).
IBIZA. Cala Talamanca, headland of Grosa y Vatarina between Ibiza harbour and Bay of Talamanca, 11.iv.1968, *Bowden & Sims* 1931 (BM).
CABRERA. *Fide* Knoche, *Fl. balear.* **2**: 186 (1922), **3**: 322 (1923).
DRAGONERA. *Fide* Knoche, *Fl. balear.* **2**: 186 (1922), **3**: 321 (1923).
CULTIVATED. Specimens seen from England (1743–1983), France, and Germany (1875).

The glandular-verrucose stems and leaves and the involucre-like bracteoles distinguish *H. balearicum* from all other species of *Hypericum*. It has such an isolated position in the genus that its affinities are not immediately obvious. The leaf-venation and floral characters, however, indicate that *H. revolutum* subsp. *revolutum* is its closest relative, in particular the broader-leaved form of that species that occurs in Ethiopia.

H. balearicum is apparently confined to the Balearic Islands, where it is quite common on Mallorca but rare on the others on which it occurs. The Italian locality cited by some authors (Liguria, Appenines above Savona) is the result of introduction (see Knoche, loc. cit.).

Map 7 Sect. 2. *Psorophytum*: 1. *H. balearicum* •.

Sect. 3. **ASCYREIA** Choisy

Prodr. monogr. fam. Hypéric.: 37, 38 (1821).

Trees (rarely), *shrubs or shrublets* up to 4·5 m tall, evergreen or deciduous, glabrous, without dark glands; branching nearly always lateral. *Stems* 2–4-lined and ± compressed when young, sooner or later becoming terete, eglandular; cortex exfoliating in strips or scales; bark fissured, smooth. *Leaves* opposite, decussate, sessile to shortly petiolate, free, deciduous at basal articulation; lamina entire, with venation pinnate, open or usually closed, the tertiary almost absent (peripheral) or ± densely reticulate; laminar glands striiform to punctiform or rarely interrupted-linear, pale; marginal gland dots pale, dense; ventral resinous gland dots sometimes present. *Inflorescence* 1–25-flowered, branching dichasial/monochasial from 1–2(3) nodes, sometimes with subsidiary flowering branches from lower nodes; bracts and bracteoles foliar or reduced, not sepalline. *Flowers* stellate to cyathiform, homostylous. *Sepals* 5, free or very rarely united at the base (Sp. 19 in part), persistent, erect to reflexed in fruit, with margin entire or minutely denticulate or ciliolate; veins numerous; laminar glands pale, linear or interrupted to rarely punctiform; submarginal, inframarginal glands absent or pale; marginal glands absent. *Petals* 5, deciduous, with apiculus present, lateral to terminal, ± prominent or sometimes obsolete, margin entire or minutely denticulate or glandular-denticulate; marginal glands absent or amber; laminar glands ± numerous, pale, linear. *Stamen fascicles* 5, free, deciduous, each with *c.* 20–100 stamens; filaments united very shortly; anthers yellow to red, gland amber; pollen types I–IV. *Ovary* with 5 incompletely (or completely ?) axile placentae, ∞-ovulate; styles 5, free or partly united; stigma capitate to small and rounded. *Capsule* 5-valved, coriaceous, rarely fleshy at first (Sp. 5), not vittate. *Seeds* ± narrowly cylindric to fusiform or cylindric-ellipsoid, often carinate or laterally winged, with apical expansion sometimes wing-like; testa linear-reticulate to linear-foveolate.

Basic chromosome number (x): 12–9; ploidy 2, 4 (6).

Habitat: open grassland, stony hillsides or cliffs, streamsides, thickets or deciduous woodland (Sp. 14); 30–4800 m.

Distribution: Pontic Turkey and Bulgaria; Pakistan, India, Sri Lanka, Nepal, Sikkim, Bhutan, Burma, W. Indonesia (Sumatra, Java, Bali, Lombok, Sulawesi), Thailand, Vietnam, China (north to southern (Xizang [Tibet], Sichuan, Shaanxi, Hubei, Anhui, Shandong, and Hebei), Taiwan (?).

42 species (+ 4 subspecies).

Key to sect. 3. *Ascyreia*

1 Leaves (at least upper) sessile, without visible dense reticulation beneath; styles free 2
Leaves all subsessile or shortly petiolate or, if sessile, then visibly ± densely reticulate-veined beneath and/or with styles ± united 7

2(1) Styles 1·8–2·5 × ovary; petal apiculus acute 3
Styles 1–1·5 × ovary; petal apiculus obtuse to rounded 4

3(2) Leaves ± elliptic, base cuneate to reflexed-auriculate; petals *c.* 3 × sepals; capsule 8–13 mm wide .... 1. ***mysurense*** (p. 210)
Leaves ± oblong, base shallowly cordate-auriculate to rounded; petals 1·5–2·5 × sepals; capsule 5–6 mm wide .... 2. ***cordifolium*** (p. 213)

4(2) Leaves linear to narrow-oblong or -lanceolate (l: b = 3–7), sharply acute to subacuminate.... 5
Leaves oblong to broadly ovate (l: b = 1·7–3 or rarely to 3·5), subacuminate to rounded 6

5(4) Leaves linear to narrowly (oblong-)lanceolate, 25–80 mm long; sepals ovate to lanceolate; inflorescence ∞-flowered .... 3. ***podocarpoides*** (p. 214)
Leaves elliptic to elliptic-oblong, 10–14 mm long; sepals narrowly elliptic; inflorescence 1-flowered .... 4. ***sherriffii*** (p. 217)

6(4) Sepals lanceolate, acute to obtuse; leaves oblong to oblong-lanceolate 6. ***pachyphyllum*** (p. 219)

Sepals ovate or oblong to elliptic, obtuse to rounded; leaves oblong-lanceolate to broadly ovate .... 7. ***augustinii*** (p. 219)

7(1) Stems prostrate to ascending or pendent, forming low mats or clumps; styles ± equalling ovary .... 5. ***reptans*** (p. 218)
Stems erect to straggling or, if creeping and rooting (Sp. 14), then styles 1·5–3 × ovary 8

8(7) Styles straight or gradually outcurving; leaves not densely reticulate-veined 9
Styles ± abruptly curved or flexed below apex or, if straight, then leaves densely reticulate-veined 12

9(8) Sepals erect in bud and fruit, rounded or obscurely apiculate; stamens 0·5–0·6 × petals; flower buds obtuse 10
Sepals spreading in bud and fruit, ± markedly apiculate or acute; stamens 0·25–0·4 × petals; flower buds acute to subacute 11

10(9) Sepals 6–9 mm long; petals narrowly obovate, 15–20 mm long; leaves ovate or ovate-oblong to lanceolate (l: b = 2–2·5) .... 8. ***williamsii*** (p. 221)
Sepals 4–5 mm long; petals ± broadly obovate to subcircular, 10–13 mm long; leaves lanceolate to narrowly elliptic (l: b = 3–4) .... 9. ***tenuicaule*** (p. 222)

11(9) Sepals ovate-oblong to broadly elliptic, apiculate or rarely rounded; petals 20–26 mm long; plant 1·3–1·6 mm tall .... 10. ***lobbii*** (p. 223)
Sepals narrowly elliptic to linear-oblong, acute; petals 12–18 mm long; plant a 'low undershrub' .... 11. ***gracilipes*** (p. 224)

12(8) Leaves sessile with base cuneate; styles free or loosely coherent 13
Leaves subsessile or shortly petiolate or, if sessile, then base rounded to cordate or styles ± united 15

13(12) Leaves concolorous, venation incompletely reticulate .... 1. ***mysurense*** (p. 210)
Leaves ± discolorous, venation completely reticulate 14

14(13) Sepals erect in fruit, (6–)9–13 mm long; stamens 0·5–0·65 × petals; branches erect to ascending .... 12. ***gaitii*** (p. 225)
Sepals ascending in fruit, 5–8 mm long; stamens 0·65–0·75 × petals; branches spreading to straggling or semi-scandent .... 13. ***oblongifolium*** (p. 226)

15(12) Leaves densely reticulate-veined beneath or styles ± united; styles at least 1·5 × ovary 16
Leaves laxly or not visibly reticulate-veined beneath; styles free, less than 1·5 × ovary (except in spp. 26, 37 and hybrids of 14) 23

16(15) Styles free or ± loosely coherent in lower half 17
Styles united almost to apex 20

17(16) Leaf base cordate, lamina ovate-oblong to ovate, with reticulate venation ± markedly prominent beneath .... 15. ***griffithii*** (p. 230)
Leaf base cuneate to rounded, lamina elliptic or oblong to ovate-oblong, with reticulate venation not or scarcely prominent beneath 18

18(17) Styles free; sepals broadly elliptic to subcircular 19
Styles coherent in lower half at first; sepals linear .... 17. ***cohaerens*** (p. 235)

19(18) Leaves all sessile; anthers yellow; sepals elliptic-oblong to narrowly ovate; stems ± spreading but not creeping or rooting .... 13. ***oblongifolium*** (p. 226)
Leaves (at least lower) shortly petiolate; anthers reddish; sepals broadly elliptic to obovate or subcircular; stems creeping and rooting .... 14. ***calycinum*** (p. 228)

20(16) Leaves densely reticulate-veined beneath, (20–)30–110 mm long; inflorescence 1–30-flowered, terminal on long shoots 21
Leaves without visible reticulate venation beneath, 10–31 mm long; inflorescence always 1-flowered, terminal on long and on short lateral shoots (19. ***longistylum***) 22

21(20) Leaves with base cuneate to rounded, or if cordate then apex rounded; leaf lamina usually broader at or above middle .... 16. ***monogynum*** (p. 231)
Leaves with base cordate-amplexicaul, apex acute to acuminate; leaf lamina elliptic-ovate to broadly ovate .... 18. ***prattii*** (p. 236)

22(20) Ovary and capsule ellipsoid, usually stipitate......... 19a. ***longistylum*** subsp. ***longistylum*** (p. 238)
Ovary and capsule globose, sessile........................... 19b. ***longistylum*** subsp. ***giraldii*** (p. 239)

23(15) Leaves with ± distinct but lax reticulate venation beneath; styles 1–1·5 × ovary; sepals broad; anthers usually orange or reddish (hybrids of 14. ***calycinum***)........................... 24
Leaves without visible reticulate venation or, if visibly reticulate, then styles shorter than ovary or sepals narrowly oblanceolate to linear; anthers pale to deep yellow 27

24(23) Sepals apiculate, broadly elliptic; petal apiculus curved-acute; anthers yellow .... 36x. ***kouytchense*** x ***calycinum*** (p. 276)
Sepals rounded, ovate-oblong to obovate; petal apiculus rounded; anthers orange or reddish 25

25(24) Anthers brick-red; stamens 0·5–0·75 × petals; green leaves usually apiculate; stems low-arching.. 31x. x ***moserianum*** (p. 266)
Anthers orange; stamens 0·35–0·5 × petals; green leaves not (or rarely sub-) apiculate; stems high-arching or spreading to ascending 26

26(25) Leaves triangular-lanceolate, acute to obtuse; petals golden yellow, not red-tinged; branches arching to spreading .... 27xx. x 'Hidcote' (p. 254)
Leaves oblong-ovate, subapiculate to rounded; petals deep golden yellow, sometimes tinged red outside; branches spreading-ascending .... 42x. x ***dummeri*** (p. 287)

27(23) Leaves in one plane (distichous) or, if tetrastichous, then broadest at middle.................... 28
Leaves in four rows (tetrastichous), broadest below middle 44

28(27) Sepals spreading to reflexed in bud and fruit; styles shorter than (or rarely equalling) ovary 29
Sepals outcurved to erect in bud and fruit or, if spreading (Sp. 26), then styles 1·5–2 × ovary 32

29(28) Leaves elliptic to oblong or ovate-oblong, subsessile; stems persistently 4-lined................ 30
Leaves narrowly lanceolate to broadly ovate, ± shortly petiolate; stems soon terete 31

30(29) Leaves all narrowly elliptic, without clear intramarginal vein; stamens *c.* 0·7 × petals; sepals ovate to elliptic .... 20. ***subsessile*** (p. 239)
Leaves oblong or ovate-oblong (lower) to elliptic (upper), usually with clear intramarginal vein; stamens 0·35–0·5 × petals; sepals triangular-ovate .... 21. ***siamense*** (p. 240)

31(30) Sepals acute to subacute; ovary and capsule narrowly ellipsoid to narrowly ovoid-conic; leaves triangular-lanceolate to broadly ovate .... 22. ***leschenaultii*** (p. 242)
Sepals apiculate to rounded; ovary and capsule ovoid-ellipsoid to ovoid; leaves oblong-lanceolate to ovate.. 22x. x 'Rowallane' (p. 244)

32(28) Leaves with distinct, usually continuous, intramarginal vein; sepals acute to acuminate; stamens 0·75–0·85 × petals .... 23. ***acmosepalum*** (p. 245)
Leaves without intramarginal vein or, if partial one present (Sp. 29), then sepals apiculate-obtuse to rounded and stamens 0·35–0·5 × petals 33

33(32) Sepals without or with very narrow hyaline margin; stems arching or spreading to pendulous but not frondose (i.e. with branches in one plane), not or scarcely ancipitous when young 34
Sepals with marked hyaline margin; stems erect to arching or spreading and then often frondose, markedly ancipitous at least when young.. 39

34(33) Styles 0·35–1 × ovary; sepals usually ovate-lanceolate to obovate-spathulate, acute to rounded 35
Styles 1·5–2 × ovary; sepals lanceolate to linear, acute or shortly aristate 38

35(34) Leaves narrowly elliptic to oblong-elliptic; flower-buds acute to obtuse; stamens 0·6–0·7 × petals .... 24. ***lagarocladum*** (p. 247)
Leaves broader below middle; flower-buds obtuse to rounded; stamens 0·25–0·4 × petals.... 36

36(35) Sepals acute to obtuse or rarely rounded-apiculate, not becoming ribbed; stamens 40–45 per fascicle.. 37
Sepals rounded or very rarely rounded-apiculate, often becoming markedly ribbed; stamens 60–80 per fascicle.. 28. ***hookerianum*** (p. 255)

37(36) Leaves apiculate-obtuse to rounded, elliptic-oblong to ovate-lanceolate; sepals ovate to oblong-spathulate; styles 0·7–1 × ovary .... 27. ***addingtonii*** (p. 251)

Leaves acute to apiculate-obtuse, lanceolate; sepals ovate-lanceolate or narrowly elliptic to oblong-spathulate; styles *c.* 0·6 × ovary .... 27x. x ***cyathiflorum*** (p. 253)

38(34) Sepals erect in bud and fruit, ovate-oblong to ovate-lanceolate or elliptic; petals obovate ..... 25. ***wilsonii*** (p. 248)
Sepals spreading in bud and fruit, narrowly oblong-lanceolate to linear; petals oblanceolate 26. ***dyeri*** (p. 249)

39(33) Leaves oblong to elliptic-oblong, with incomplete intramarginal vein.............. 29. ***lacei*** (p. 258)
Leaves narrowly elliptic or broader below middle, without intramarginal vein (***H. patulum*** sens. lat.).. 40

40(39) Sepals entire, at least outer broadly elliptic or broadly oblong to circular; stems erect, not frondose... 30a. ***henryi*** subsp. ***hancockii*** (p. 261)
Sepals eroded-denticulate or, if entire, then elliptic or narrowly oblong to oblanceolate; stems erect to spreading, sometimes frondose.. 41

41(40) Sepals eroded-denticulate to subentire, usually apiculate, broadly elliptic to broadly ovate; leaf apex usually apiculate-obtuse to rounded.. 42
Sepals entire, rarely apiculate, elliptic to narrowly oblong or obovate-spathulate; leaf apex acute to rounded-apiculate 43

42(41) Stems erect to arching or rarely divaricate, not frondose, ± persistently 4-lined; leaf-apex acute to rounded but rarely apiculate; capsule 10–14 mm long .... 30b. ***henryi*** subsp. ***henryi*** (p. 263)
Stems spreading, sometimes frondose, soon 2-lined; leaf-apex obtuse to rounded, always apiculate; capsule 9–11 mm long.. 31. ***patulum*** (p. 265)

43(41) Flower-buds acute to obtuse; sepals subacute to rounded; stems erect or arching, not or only distally frondose.. 30c. ***henryi*** subsp. ***uraloides*** (p. 263)
Flower-buds obtuse to rounded; sepals rounded; stems arching, often frondose .... 32. ***uralum*** (p. 268)

44(27) Leaves with main lateral venation (usually conspicuous) closed and/or with tertiary venation rather densely reticulate; sepals broadest at middle, entire 45
Leaves with main lateral venation (usually obscure) open, with tertiary venation not conspicuously reticulate; sepals usually broadest below middle, often denticulate 48

45(44) Sepals outcurved to recurved in bud and fruit, usually acute; leaves lanceolate to triangular-ovate, usually subacute to acuminate; flowers stellate to shallowly cyathiform, buds acute to apiculate 46
Sepals erect in bud and fruit, usually obtuse to rounded; leaves lanceolate-oblong to broadly rhombic or subcircular, obtuse to emarginate; flowers ± deeply cyathiform, buds obtuse (or rarely acute) to rounded (35. ***bellum***) 47

46(45) Petals obovate-oblanceolate, flowers stellate; stamens *c.* 0·6 × petals; leaves glaucous beneath, petiole 0·5–2 mm long.. 33. ***maclarenii*** (p. 270)
Petals broadly obovate to obovate-subcircular, flowers shallowly cyathiform; stamens 0·35–0·4 × petals; styles 0·85–1 × ovary; leaves not glaucous beneath, petiole 2–4 mm long .... 34. ***choisianum*** (p. 271)

47(45) Sepals acute to obtuse, elliptic, often foliaceous; flowers 40–60 mm in diam.; styles 0·35–0·7 × ovary; leaves narrowly oblong to ovate-oblong (l: b = usually 2 or more) .... 35a. ***bellum*** subsp. ***latisepalum*** (p. 274)
Sepals rounded, narrowly elliptic to obovate, not foliaceous; flowers 25–35 mm in diam.: leaves ovate-oblong to subcircular (l: b = 2 or less) .... 35b. ***bellum*** subsp. ***bellum*** (p. 275)

48(44) Sepals lanceolate to narrowly elliptic or oblanceolate, acute or acuminate; petal apiculus acute to obtuse or obsolete... 48
Sepals ovate to circular or obovate, acute to rounded; petal apiculus obtuse to rounded or absent.. 53

49(48) Stamens 0·65–0·8 × petals; petals spreading or reflexed .... 36. ***kouytchense*** (p. 275)
Stamens 0·3–0·6 × petals; petals ± incurved 50

50(49) Styles equalling or longer than ovary; stamens *c.* 0·6 × petals; inflorescence (1)3–14-

flowered 51
Styles shorter than ovary; stamens 0·3–0·4 × petals; inflorescence 1(2–4)-flowered 52

51(50) Ovary 4–5 mm long, styles *c.* 1·2 × as long, straight or flexuous; inflorescence branches relatively slender; leaves with dense ventral glands .... 37. ***stellatum*** (p. 278)
Ovary 5–6·5 mm long, styles 1–1·1 × as long, outcurved; inflorescence branches usually relatively stout; leaves usually with few or without ventral glands .... 38. ***lancasteri*** (p. 279)

52(50) Petals 30–35 mm long; flowers shallowly cyathiform; leaves elliptic-oblong to oblong-lanceolate, obtuse to rounded; styles *c.* 0·75–0·9 × ovary ..... 36xx. x 'Eastleigh Gold' (p. 277)
Petals 15–20 mm long; flowers deeply cyathiform; leaves triangular-ovate to triangular-lanceolate; styles *c.* 0·5 ovary .... 39. ***curvisepalum*** (p. 281)

53(48) Sepals acute to obtuse; stems ± persistently 4-lined 54
Sepals subapiculate to rounded; stems soon terete .... 42. ***forrestii*** (p. 286)

54(53) Styles exceeding ovary; stamen fascicles 0·75–0.85 × petals; leaf apex usually rounded .... 41. ***pseudohenryi*** (p. 283)
Styles equalling or shorter than ovary; stamen fascicles 0·5–0·7 × petals; leaf apex usually obtuse or apiculate .... 40. ***beanii*** (p. 282)

1(12). **Hypericum mysurense** Wallich ex Wight & Arnott

Prodr. fl. penins. ind. or. **1**: 99 (1834); Thwaites, *Enum. pl. zeyl.*: 48 (1858) ('*mysorense*'); Dyer in Hook. f., *Fl. Brit. Ind.* **1**: 253 (1874) ('*mysorense*'); Cameron, *Cat. pl. Bot. Gard. Bangalore* 2nd ed.: 16 (1891); Cooke, *Fl. Bombay* **1**: 74 (1901) ('*mysorense*'); Rao, *Fl. pl. Travancore*: 28 (1914) ('*mysorense*'); Gamble, *Fl. Pres. Madras* **1**: 70 (1915) ('*mysorense*'); Fyson, *Fl. Nilgiri & Pulney hill-tops* **1**: 37 (1915) ('*mysorense*'); *ibid.* **2**: 28, t. (1915); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* **21**: 176 (1925)('*mysorense*'); 2nd ed. *Fl. S. Ind. hill stns* **1**: 46 (1932) ('*mysorense*') **2**: 20, t. (1932); Ramaswamy & Razi, *Fl. Bangalore distr.*: 394 (1973) ('*mysorensis*'); Saldana & Nicolson, *Fl. Hassan distr.*: 128 (1976). Types: India. Mysore, Nundydroog, 17.iii.1806, *Heyne* in *Wallich* 4808 (K-W!, lectotype–mihi; E!, K!, isolectotype); [Tamil Nadu] Neelgherries, *Notan* in *Wallich* 4808C (K-W! syntype).

H. auritum Moon, *Cat. Ind. exot. pl. Ceylon*: 56 (1824), nomen.

H. mysurense Wallich, *Numer. list* No. 4808 (1831), nomen; Wight, *Cat. Ind. pl.*: 20, no. 331 (1833), nomen.

Norysca myrtifolia Spach, *Hist. nat. vég.* Phan. **5**: 428 (1836); in *Annls. Sci. nat.* (Bot.) II, **5**: 364 (1836); Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856). Type: India, 'Dans les montagnes de l'Inde', *Leschenault* (P!).

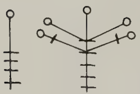
Norysca mysorensis (Wallich ex Wight & Arnott) Wight, *Ic. pl. ind. or.* **1**: t. 56 (1838) ('*Norisca*'); Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856); Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 98 (1951).

H. norysca Steudel, *Nomencl. bot.* 2nd ed, **1**: 789 (1840). Type as for *Norysca myrtifolia*.

Icones: Wight, *Ic. pl. ind. or.*: t. 56 (1838); Fernando, *Wildflowers Ceylon*: 64. t. 16, f. 8 (1954); Fig. 12.

Shrub (0·6)1·2–2·4 m tall, bushy, with branches erect to ascending. *Stem* red, 4-lined and ancipitous when young, eventually terete; internodes 4–16 mm long, shorter than leaves; bark grey. *Leaves* sessile 4-ranked; lamina 7–45 × 3–18 mm, narrowly to broadly elliptic or oblong-elliptic, acute, margin plane, base cuneate to reflexed-auriculate, concolorous, not or scarcely glaucous, subcoriaceous to chartaceous, lower ones soon deciduous; venation: 3(4) pairs of main laterals, not or sparsely branched, the midrib pinnately branched, with tertiary reticulum lax and inconspicuous or rarely rather dense; laminar glands linear, between main lateral veins, or ± interrupted by reticulum to form streaks and dots; ventral glands absent. *Inflorescence* 1–3-flowered or, if flowers more (4–6), then usually from two close nodes, rarely up to *c.* 10-flowered from apical node with flowering branches from second node: pedicel 7–20 mm long; bracts foliar but smaller, persistent. *Flowers* 40–60 mm in

Fig. 12 *H. mysurense*: (a) habit: (b) leaf section; (c) flower bud; (d) flower; (e) sepal; (f) petal; (g) stamen fascicle; (h) anthers; (i) capsule (a × 1; d × 2; c, e–g, i × 4; b × 8; h × 20). (a) *Saulière* 7, *Clarke* 10498A; (b, c) *Vine* 10; (d–h) *Evershed* s.n.; (i) *Hohenacker* 435.



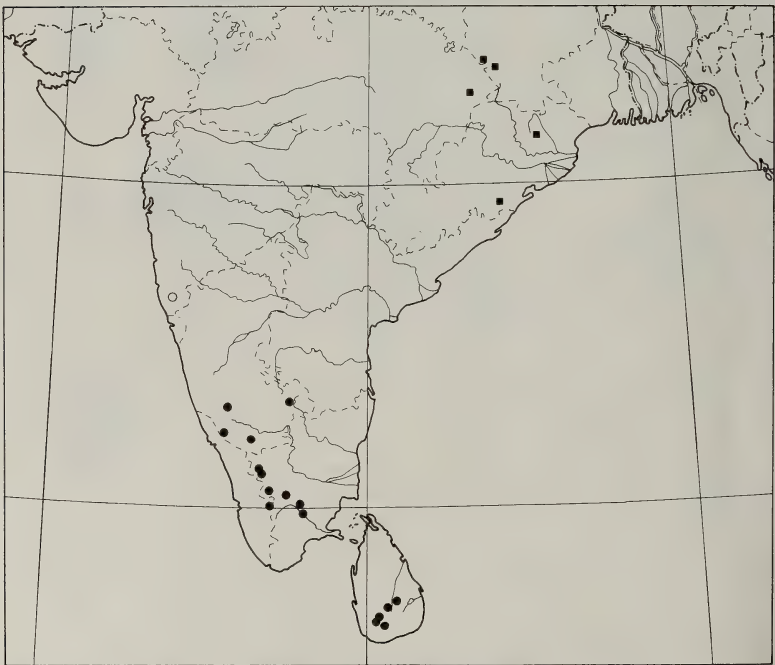
diam., stellate; buds broadly to narrowly conical, acute. *Sepals* 6–10(13) × 3–5 mm, free, imbricate, subequal, erect in bud and fruit, rather broadly to narrowly ovate or ovate-triangular, sharply acute to subacute, margin entire or very rarely subentire, midrib sometimes visible, often then incrassate above, other veins not prominent; laminar glands linear, numerous. *Petals* rich golden yellow, sometimes tinged red, spreading, 20–33 × 13–22 mm, *c.* 3 × sepals, narrowly obovate, with apiculus subterminal, acute to rounded; margin entire, eglandular. *Stamen fascicles* each with *c.* 40 stamens, longest 10–17 mm long, *c.* 0·5 × petals; anthers yellow. *Ovary* (4)5–6 × 3–4 mm, broadly ovoid to ovoid-pyramidal; styles (8)10–13 mm long, *c.* 2·5 × ovary, free or loosely coherent, erect; stigmas small. *Capsule* (8)10–12(14) × 8–13 mm, broadly ovoid to narrowly ovoid-conic. *Seeds* dark reddish-brown, 2·2 mm long, cylindric, not winged, slightly carinate, finely linear-foveolate. 2n = ?

In thickets and on wooded and open hillsides, on poor soil; 1050–2100 m.

Sri Lanka, south India north to Konkan (Tamil Nadu, Kerala, Karnataka, western Maharashtra). Map 8.

SRI LANKA. Central Prov.: Nuwara Eliya Distr., 5 km S. of Nuwara Eliya, near Nanu Oya, 1890 m, 10.iii.1969, *Grierson* 1082 (E); Adam's Peak, iii.1846, *Thwaites* (K); Nuwara Eliya [Neuer Ellia], 1800 m, *Gardner* 112 (A, BM, K); [without precise locality], 1853, *Thwaites* 48 (BM, BO, FR, G).

INDIA. Tamil Nadu: Madurai Distr., Palni [Pulney] Hills, Kodaikanal, 19.v.1897, *Bourne* (K); Anaimalai [Anamalley] Hills, pre-1885, *Beddome* 371 (BM);



Map 8 Sect. 3. *Ascyreia*: 1. *H. mysurense* ●, ○ (unlocalised). *H. gaitii* ■.

Nilgiri Hills, above Wellington–Kotogiri Road, Black Bridge Reserve Forest, 21.iii.1944, *Sinclair* 3374 (E); in montibus Nilagiri, 1851, *Hohenacker* 1113 (BM, JE, K). Kerala: Munnar, Devicolam road, 1500 m, 13.iii.1934, *Erlanson* 5554 (A). Karnataka: prope Mercara, ii.1847, *Hohenacker* 435 (BM, E, JE, K); Baba Budan Hills, Santaveri, xi.1908, *Meebold* 10149 (E). Maharashtra: Konkan, etc., *Stocks* (A, BM, K, L); Bombay Presidency, pre-iv.1878, *Dalzell* (K).

H. mysurense shows clinal variation from Sri Lanka and the Palni Hills of Tamil Nadu northward to near Bombay. The southern plants are closer to the African *H. revolutum* subsp. *keniense* and *H. lanceolatum* subsp. *angustifolium* from Réunion (sect. 1. *Campylosporus*) in having narrow leaves without or with little tertiary reticulation and with linear laminar glands, and long acute buds and sepals. Towards the northern end of its range, the leaves tend to be relatively broader with marked tertiary venation and dissected laminar glands, and the buds and sepals shorter and subacute. It does not seem possible, however, to recognise infraspecific taxa.

The Socotran plants sometimes included in *H. mysurense* belong to sect. 1. *Campylosporus* (5. *H. balfourii*).

2(13). **Hypericum cordifolium** Choisy

in DC., *Prodr. syst. nat. regni veg.* **1**: 545 (1824); Dyer in Hook. f., *Fl. Brit. Ind.* **1**: 253 (1874) pro parte excl. syn. *H. acutum* Wall.; R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925); Banerji in *J. Bombay Nat. Hist. Soc.* **51**: 774 (1953); Anon. in *Bull. Dep. Med. Pl. Nepal* **4**: 7 (1973); Murata in *Acta Phyt. Geobot.* **25**: 110 (1973); Robson in *J. Jap. Bot.* **52**: 276, f. 1 (1977), in Hara & Williams, *Enum. fl. pl. Nepal* **2**: 61 (1979). Type: Nepal, Sheopore [Sheopuri] 1821, *Wallich* 4804 (G-DC!, holotype; BM!, E!, F!, K-W!, L!, SING!).

H. bracteatum Buch.-Ham. ex D. Don, *Prodr. fl. nepal.*: 217 (1825), nom. illegit. superfl.; Wallich, *Numer. list*: No. 4804 (1831); Wallich, *Pl. asiat. rarior.* **3**: t. 220 (1832). Types: (all Nepal) 'ad Thankote [Tancote] in Nepalia propria', 16.iv.1802, *Hamilton* (BM!, lectotype); 'ad Narainhetty', 10.x.1802, *Hamilton* (BM!); Nepalia, 1819–20, *Wallich* (BM!, SING!); Nepalia [Sheopore], 1821, *Wallich* 4804 (BM!, E!, FI!, K-W!, L!, SING!); Nepalia [Sheopore], ii.1821, *Wallich* (BM!, K!) (all syntypes).

H. lungusum Buch.-Ham. ex D. Don, *Prodr. fl. nepal.*: 218 (1825), in synon.

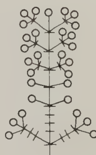
Eremanthe cordifolia (Choisy) K. Koch, *Hort. dendrol.*: 65 (1853).

Norysca cordifolia (Choisy) Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856); Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 98 (1951); in Kihara, *Fauna & fl. Nepal Himal.*: 179 (1955); in Hara, *Fl. eastern Himal.* **2**: 81 (1971).

Norysca urala var. *angustifolia* Y. Kimura in Hara, *Fl. eastern Himal.*: 210 (1966) pro parte quoad specim. *Hara, Kanai & Kurosawa*. 20.ix.1963.

Icon: Wallich, *Pl. asiat. rarior.* **3**: t. 220 (1832).

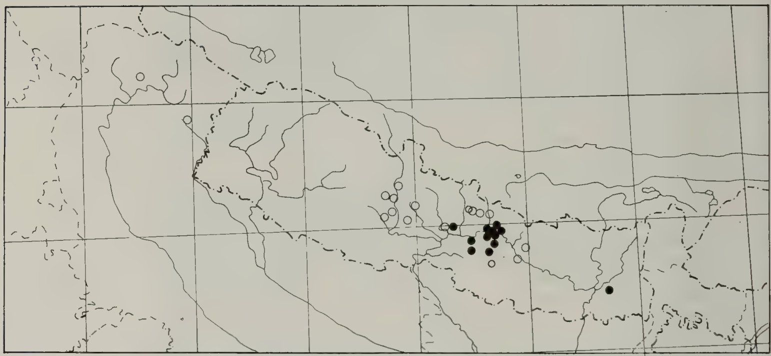
Shrub 1–1·3 m tall, with branches erect to arching or pendent. *Stems* 2- or partially 4-lined and ancipitous when young, soon terete; internodes 7–20 mm long, shorter than leaves; bark dark grey. *Leaves* sessile; lamina 18–40(–62) × 5–16(–23) mm, elliptic-oblong to oblong, apiculate or shortly acuminate, margin plane, base rounded to shallowly cordate-auriculate, paler beneath, ± glaucous on both sides, subcoriaceous; venation: 3 pairs main laterals, with intermediates and midrib branches distally, without visible tertiary reticulum; laminar glands streaks and a few dots; ventral glands dense. *Inflorescence* 1–7-flowered, from apical node, and with 1–3-flowered lateral branches from up to 12 nodes, rounded-pyramidal to cylindric, sometimes with subsidiary flowering branches below; pedicels 7–14 mm long; bracts ovate, persistent. *Flowers* 30–50 mm in diam., stellate; buds narrowly conic to cylindric, acute. *Sepals* 8–13 × 3–5 mm, free, imbricate, subequal to rather unequal, erect to ascending in bud and fruit, lanceolate or rarely ovate or ovate-elliptic, sharply acute to apiculate, with margin entire; midrib obscure or not visible, veins not prominent; laminar glands numerous, linear. *Petals* bright yellow, sometimes tinged red, spreading, (15–)20–22 × 7–12 mm, 1·5–2·5 × sepals, narrowly obovate to oblanceolate, with apiculus acute, subterminal; margin entire, eglandular. *Stamen*



fascicles each with *c.* 25 stamens, longest *c.* 15 mm long, 0·65–0·75 × petals; anthers bright yellow. *Ovary* 4–6·5 × 2·5–4·5 mm, ellipsoid; styles 7·5–12 mm long, 1·8–2·5 × ovary, free, erect, sometimes outcurved near apex; stigmas capitate. *Capsule* 8–10 – 5–6 mm, ± broadly ovoid. *Seeds* dark reddish-brown, *c.* 0·9 mm long, narrowly cylindric, not carinate, shallowly linear-reticulate. 2n = ?

On steep banks, rocky hillsides and open, dry situations; 900–1900 m.

Nepal (central, in Kathmandu region; also east, one record). Map 9.



Map 9 Sect. 3 *Ascyreia*: 2. *H. cordifolium* •, 3. *H. podocarpoides* ○.

NEPAL. Central: Sheopuri, N. of Kathmandu, 1875 m, 5.iv.1965, *Schilling* 302 (K); Katunji Ridge, 1050 m, 8.iv.1953, *Gardner* 194 (BM, E); Tribeni, 1500 m, 10.iv.1973, *Dobremez* 1792 (BM); near Kathmandu, Sundarijal Waterfall, 1600 m, 20.ix.1963, *Hara, Kanai & Kurosawa* (TI); Gurka Himalaya, N. of town of Gurka, ± 1050 m, 29.iii.1983, *Schilling* 2656 (BM). East: hills N. of Dharan, 20.x.1980. *Schilling* (BM).

CULTIVATED. Specimens seen from India (Calcutta, nineteenth century) and England (1980).

H. cordifolium is a relict species which occupies a critical position, as regarded both morphology and distribution, for the understanding of the evolution of the genus. Ancestrally it is linked (to the south) with *H. mysurense*; morphologically it is the nearest species in sect. 3. *Ascyreia* to sect. 10. *Olympia* (radiating from south-western Anatolia) and its derivatives (sects 11–16), and sect. 17. *Hirtella* (radiating from eastern Anatolia) and its relatives (sects 18–19) (see p. 325); and it has a near relative in the Himalaya itself (*H. podocarpoides*). Hundley & KoKo's record of *H. cordifolium* from Burma (Lace, 1961: 19) should be treated with reserve in the absence of a confirmatory specimen. It could be an error for 6. *H. pachyphyllum*.

H. cordifolium is easily distinguished from all other species in sect. *Ascyreia* by its combination of elliptic-oblong to oblong, auriculate leaves, ovate, acute to apiculate sepals, and long styles. For the differences between it and *H. podocarpoides*, see below (p. 215) and Robson (1977*b*: 277).

3(14). **Hypericum podocarpoides** N. Robson

in *J. Jap. Bot.* **52**: 276, f. 1 (1977); in Hara & Williams, *Enum. fl. pl. Nepal* **2**: 62 (1979). Type: Nepal, from Tinpipli to Nepalthoke, *c.* 900 m, 7.iv.1948, *Banerji* 95 (CAL, holotype; Hb. Banerji!, isotype).

H. acutum Wallich, *Numer. list*: No. 4807 (1831), nomen; Dyer in Hook. f., *Fl. Brit. Ind.* **1**: 253 (1874) nom. synon., non Moench (1784).

H. cordifolium sensu Dyer in Hook. f., *Fl. Brit. Ind.* **1**: 253 (1874) pro parte, quoad syn. *H. acutum* Wall., non Choisy (1824).
H. hookerianum var. *lineare* Banerji in *J. Ind. bot. Soc.* **31**: 152 (1952); in *J. Bombay nat. Hist. Soc.* **51**: 774 (1953); in *Candollea* **19**: 219 (1964); in *Rec. bot. Surv. Ind.* **19** (2): 27 (1966). Type as for *H. podocarpoides*.

Icon: Fig. 13.

Shrub 0·45–1·2 m tall, with branches spreading or pendulous. *Stems* 4-lined and ancipitous when young, eventually terete; internodes 5–15 mm long, shorter than leaves; bark grey-brown. *Leaves* sessile or with very short flat petiole; lamina (20–)25–80 × 4–20 mm, linear to narrowly lanceolate or narrowly oblong-lanceolate (broader towards the inflorescence), sharply acute to subacuminate, margin plane to recurved, sometimes reddish, subincrassate, base auriculate-truncate or subcordate to rounded, discolorous, densely glaucous beneath, coriaceous; venation: 2–3 pairs main laterals with numerous midrib branches distally, without visible tertiary reticulum; laminar glands mostly undulating lines and streaks (crossing the veins) with some dots; ventral glands sparse or absent. *Inflorescence* 5–13(–20)-flowered, from 1–2(3) nodes, subcorymbiform to broadly pyramidal, or sometimes pseudumbellate owing to the very short apical internode, occasionally with subsidiary branches below; pedicels 4–25 mm long; bracts oblong or ovate to lanceolate, those on main stem foliar and usually in a pseudo-whorl, others reduced, deciduous. *Flowers* (25–)35–50 mm in diam., stellate; buds ovoid, acute. *Sepals* 8–14 × 3–6 mm, free, imbricate, subequal, spreading in bud and fruit, narrowly ovate to lanceolate, acute to subacute, with margin entire or slightly irregular to eroded-denticulate towards apex; midrib of outer 1–3 visible, veins not prominent; laminar glands numerous, linear or interrupted. *Petals* bright yellow, not tinged red, spreading, 13–28 × 8–12 mm, 1·6–2 × sepals, ± narrowly obovate, with apiculus very acute to almost absent, lateral; margin entire, eglandular. *Stamen fascicles* each with *c.* 30 stamens, longest 8–15 mm long, 0·5–0·65 × petals; anthers bright yellow. *Ovary* 4·5–6 × 2·5–4 mm, narrowly to rather broadly ellipsoid; styles 3·5–6·5 mm long, 1–1·2 × ovary, free, suberect to divergent, outcurved near apex; stigmas capitate. *Capsule* 8–13 × 7–10 mm, ellipsoid to ovoid. *Seeds* dark reddish-brown, 0·9–1 mm long, narrowly cylindric, very narrowly carinate, very shallowly linear-reticulate. 2n = ?

On grassy slopes, rock faces and in stony river beds, in dry situations; (570)840–2100(–2400) m.

Nepal (central, west), India (Kumaun). Map 9.

NEPAL. Central: Kali Gandaki, Tatopani, 1350 m, 25.v.1954, *Stainton, Sykes & Williams* 5438 (BM); Godavari, S. of Kathmandu, 1950 m, 9.xii.1965, *Schilling* 713 (K). West: Kali Gad, 1200 m, 25.vii.1953, *Tyson* 118 (BM).

INDIA. Uttar Pradesh: Kumaun, Ramari, 1350 m, *Strachey & Winterbottom* 5 (BM, GH, K); Kumaun, between Gini [Ganai] and Munshiari [Mansiari], 1800–2400 m, 17.viii.1884, *Duthie* 2768 (K).

H. podocarpoides has been confused with *H. cordifolium* since Dyer made them synonymous in *Fl. Brit. India* (Dyer, 1874). They are, however, quite distinct. Although they approach one another in leaf shape, the respective variations do not overlap; and they also differ in leaf thickness, colour and glandularity, and in inflorescence shape, stamen length, ovary size and style length.

Whereas *H. cordifolium* occurs in a restricted area of central Nepal with an isolated locality in the east of that country, *H. podocarpoides* is found mainly further west (Robson, 1977*b*: fig. 1). The area of overlap in central Nepal, however, is more apparent than real, as *H. podocarpoides* is absent from the immediate region where *H. cordifolium* occurs, although it is present to the east and south-east of it. There also appears to be a gap in the distribution of *H. podocarpoides* in the west of Nepal. In addition, *H. cordifolium* flowers in the spring and *H. podocarpoides* in the autumn (teste A. Schilling).

It therefore seems that, although *H. cordifolium* and *H. podocarpoides* are both closely related to *H. mysurense* and to each other, they have diverged from this

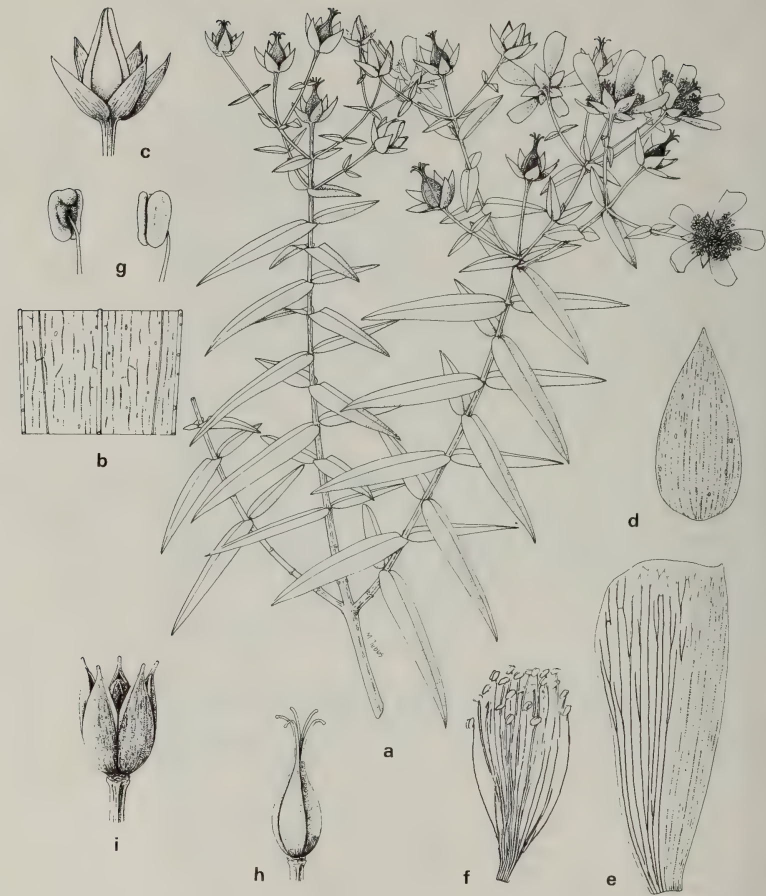


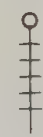
Fig. 13 *H. podocarpoides*: (a) habit; (b) leaf section; (c) flower bud; (d) sepal; (e) petal; (f) stamen fascicle; (g) anthers; (h) ovary; (i) capsule (a × 1; c, i × 4; b, d–f, h × 6; g × 40). (a–g) *Stainton, Sykes & Williams* 8705; (h) *Schilling* 2431; (i) *Stainton, Sykes & Williams* 575.

common ancestor and subsequently come to occupy overlapping areas without hybridising or introgressing.

4(15). **Hypericum sherriffii** N. Robson

in *Notes Roy. bot. Gdn Edinb.* **41**: 133, ff. 1, 3 (1983). Type: Bhutan, Chungkar, 24.xi.1938, *Ludlow & Sherriff* 6784 (BM!, holotype).

Icon: Robson & Long in *Notes Roy. bot. Gdn Edinb.* **41**: 134, f. 1 (1983).

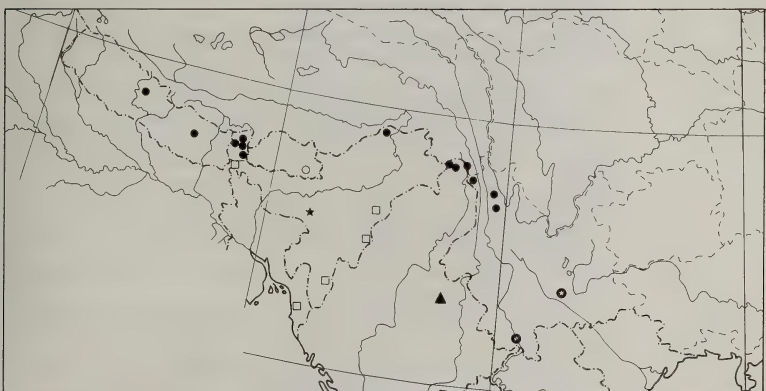


Shrub 0·6–1·2 m tall, with branches spreading or pendulous, ± frondose ? *Stems* 4-lined and ancipitous when young, eventually unlined and compressed; internodes 1–3·5 mm long, shorter than leaves; bark greyish-brown. *Leaves* sessile or subsessile; lamina 10–14 × 3–5 mm, elliptic to elliptic-oblong, acute to subacute-apiculate, margin plane, base cuneate, discolorous, glaucous beneath, coriaceous; venation: 2–3 pairs of looping main laterals without other midrib branches or tertiary reticulum; laminar glands short streaks and dots; ventral glands dense. *Inflorescence* 1-flowered; pedicels 5–6 mm long; bracts deciduous. *Flowers* not seen. *Sepals* 5–8 × 1·5–2 mm, free, not imbricate ?, subequal, spreading in fruit, linear-elliptic, acute, with margin entire or minutely denticulate below apex; midrib visible, veins not prominent; laminar glands 4–6, linear, punctiform and ± numerous distally. *Petals, stamen fascicles* and *ovary* not seen; styles (in fruit) 3·5–4 mm long; stigmas small. *Capsule* 8–11 × 5·5–5 mm, ellipsoid-ovoid. *Seeds* dark reddish-brown, *c.* 0·8 mm long, narrowly cylindric, very narrowly carinate or not, very shallowly linear-foveolate. 2n = ?

On cliff faces and steep rocky slopes; 2100 m.

Bhutan (south-east). Map 10.
BHUTAN. Chungkar, 2100 m, 24.xi.1938, *Ludlow & Sherriff* 6784 (BM).

Despite the absence as yet of flowering specimens, it is possible to see *H. sherriffii* as a relative of *H. podocarpoides*, smaller in all its parts and with cuneate leaf-bases, narrower sepals and solitary flowers. The small leaves on apparently frondose shoots with very short internodes remind one of *H. uralum*, but the spreading habit, narrow sepals and narrow capsules are quite different.

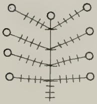


Map 10 Sect. 3 *Ascyreia*: 4. *H. sherriffii* ○, 5. *H. reptans* ●, 6. *H. pachyphyllum* ▲, 7. *H. augustinii* ✪, 10. *H. lobbii* ★, 11. *H. gracilipes* □.

5(16). **Hypericum reptans** Hook. f. & Thomson ex Dyer

in Hook. f., *Fl. Brit. Ind.* **1**: 255 (1874); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925); Hand.-Mazz., *Symbolae sinicae* **7**: 401 (1931); N. Robson in *J. Roy. Hort. Soc.* **95**: 492 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 152 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 422 (1973); N. Robson in Hara & Williams, *Enum. fl. pl. Nepal* **2**: 62 (1979). Types: Sikkim, Lachen, 3300 m, 10.vii.1849, *J. D. Hooker* (K!, lectotype–mihi); Lachen, 3300 m, 17.vi.1849, *J. D. Hooker* (K!, syntype); temperate Sikkim Himalaya, 2100–3300 m, *J. D. Hooker* (BM!, E!, FI!, GH!, K!, L!, SING!, syntypes).

Icon: Mansfield in *Bull. Alpine Gard. Soc.* **5**: 178 (1937).



Shrublet, prostrate or ascending to 0·3 m tall, forming clumps or mats up to 1 m in diam., sometimes pendent from rocks, with branching pinnatiform, branches rooting. *Stems* red to orange, 4-lined and ancipitous when young, eventually 4-lined to subterete; internodes 5–15 mm long, shorter than to exceeding leaves; bark reddish-brown, flaking. *Leaves* petiolate, with petiole 0·5–1·5 mm long; lamina 7–16(–22) × 2–9 mm, increasing in size and relative width up stem, elliptic or elliptic-oblong to oblanceolate or more rarely obovate, obtuse to rounded, margin plane, base cuneate, paler or ± glaucous beneath, chartaceous; venation: 1–2(3) pairs main laterals, with midrib branched distally and dense, often obscure tertiary reticulum; laminar glands medium to short streaks and dots; ventral glands absent. *Inflorescence* 1-flowered, with flowering branches from middle and upper parts of current stem; pedicels 4–8 mm long; bracts (uppermost leaf-pair) foliar, persistent. *Flowers* 20–30 mm in diam., ± deeply cyathiform; buds ovoid-ellipsoid, rounded. *Sepals* 6–14 × 2·5–6·5 mm, free, imbricate, unequal, reflexed in bud, spreading in fruit, oblong to obovate or oblanceolate, obtuse or rarely apiculate to rounded, with margin entire; midrib distinct, veins not prominent; laminar glands distal streaks and dots, relatively few. *Petals* deep golden yellow, sometimes flushed red, ± markedly incurved, 11–18 × 7–12 mm, *c.* 1·3–1·9 × sepals, broadly obovate, with apiculus subterminal, rounded, almost absent; margin entire, eglandular. *Stamen fascicles* each with *c.* 20–30 stamens, longest 4·5–6 mm long, 0·25–0·35 × petals; anthers golden yellow. *Ovary* 3–4 × 3–5 mm globose; styles (2·5) 3–4(4·5) mm long, about equalling ovary, free, erect, ± sharply outcurved near apex; stigmas subcapitate. Capsule 6–10 × 6–10 mm, globose to depressed-globose, indehiscent, ± baccate, brick-coloured when ripe. *Seeds* dark reddish-brown, 0·6–0·7 mm long, cylindric to cylindric-ellipsoid, narrowly carinate, very shallowly linear-foveolate. 2n = ?

Dry to moist, open to shaded habitats (gravel or earth slopes, on boulders, hanging over cliffs, marshy places), (2100)2640–3900(4200) m.

China (NW. Yunnan, SE. Xizang [Tibet]), Burma (north), India (Arunachal Pradesh), Sikkim, Nepal (east, central). Map 10.

CHINA. Yunnan: Salween–Kiukiang Divide, Haipuh, 3500 m, 2.xi.1938, *Yü* 22945 (E); Gongshan [Kungshan, Tala], 11.xi.1940, *Feng* 8361 (KUN). Xizang [Tibet]: Mêdog [Meto, Motui], 2700 m, 3.viii.1974, *Zhuanzang team* 74–4025 (KUN).

BURMA. Kachin: Nam Tamai valley, 3000 m, 8.ix.1937, *Kingdon Ward* 13183 (BM); Seingkhu Wang valley, 3300 m, 30.vii.1926, *Kingdon Ward* 7224 (BM).

INDIA. Arunachal Pradesh: Lo La, Pachakshiri, 2850 m, 8.x.1938, *Ludlow & Sherriff* 6564 (BM).

SIKKIM. Mempup, 3000 m, 30.vii.1913, *Cooper* 381 (A, BM, E); Yeumthang, 3900 m, 30.vii.1947, *Cave* 175 (E, K).

NEPAL. Central: Annapurna Himal, Seti Khola, 3150 m, 5.viii.1954, *Stainton, Sykes & Williams* 6688 (BM, E). East: Foketey, 3900–4200 m, 1930, *Dhwoj* 491 (BM, E).

CULTIVATED. Specimens have been seen from England (1983), Scotland (*c.* 1975), Ireland (1968), and the Netherlands (1945).

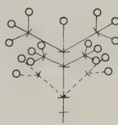
The flowers of *H. reptans* are like small versions of those of *H. hookerianum* with the sepals more foliose and the ovary globose. The habit, however, is quite different,

varying from ascending to prostrate, with flowering branches from any or all nodes along the rooting stem. In addition, the small, elliptic to obovate leaves and the indehiscent, ± baccate fruits are distinctive. The branching, leaf form, leaf venation and sepal form all indicate a relationship with *H. sherriffii* (from Bhutan); and the distribution along the Himalayan range on either side of that country (but apparently not in Bhutan itself) is consistent with this relationship.

6(17). **Hypericum pachyphyllum** Collett & Hemsley

in *J. Linn. Soc.* **28**: 24, t. 3 (1890). Type: Burma, Shan Hills, 1200 m, *Collett* 660 (K!, holotype).

Icon: Collett & Hemsley, *tom. cit.*: 24, t. 3 (1890).



Shrub or undershrub (height unrecorded), with branches erect, rigid. *Stems* 4-lined and ancipitous when young, eventually terete; internodes 8–20 mm long, shorter than leaves; bark reddish-brown. *Leaves* sessile or with very short flat petiole; lamina 35–50 × 10–20 mm, oblong to oblong-lanceolate, subapiculate to obtuse, margin plane, reddish, subincrassate, base auriculate to broadly cuneate, discolorous, densely glaucous beneath, coriaceous; venation: 3 pairs main laterals, with midrib branched distally, without visible tertiary reticulum; laminar glands mostly lines and long streaks; ventral glands sparse. *Inflorescence c.* 10–25-flowered, from 2–4 nodes, subcorymbiform, with very short apical internode, sometimes with branches below; pedicels 9–17 mm long; bracts on main stem broadly ovate, forming a pseudo-whorl, others reduced, oblong to elliptic, deciduous. *Flowers* 40–50(–60) mm in diam., stellate or shallowly cyathiform; buds broadly to narrowly conic, acute to subacuminate. *Sepals* 8–14 × 3·5–5·5 mm, free, imbricate, subequal, ± spreading in bud and fruit, lanceolate, acute to subacute, with margin entire; midrib obscure except sometimes near apex, veins not prominent; laminar glands numerous, linear or long streaks. *Petals* bright? yellow, not tinged red, spreading or slightly incurved, 20–25 × 9–13 mm, *c.* 2–2·5 × sepals, oblanceolate to rather broadly ovate, with apiculus subterminal, rounded or almost absent; longest 10–14 mm long, *c.* 0·5 × petals; anthers bright yellow. *Ovary* 5–6 × 3·5 mm, narrowly ellipsoid; styles 7·9 mm long, 1–1·5 × ovary, divergent, outcurved towards apex; stigmas capitate. *Capsule* 10–13 × 6–8 mm, ovoid. *Seeds* not seen. 2n = ?

On open slopes and in thickets and marshy areas; 600–1200 m.

Burma (Shan States). Map 10.

BURMA. Shan States: between Lashio and Namkhan, 600–900 m, 22.xii.1952, *Kingdom Ward* 20307 (BM); Shan Hills, 1200 m, v.1888, *Collett* 660 (K); [no locality], pre ii.1906, *Brandis* (K).

H. pachyphyllum is intermediate, morphologically and geographically, between the Nepalese *H. podocarpoides* and *H. augustinii* (from southern Yunnan). It has a restricted relict distribution.

7(18). **Hypericum augustinii** N. Robson

in *J. Roy. Hort. Soc.* **95**: 495 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 150 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 408 (1973); N. Robson in *J. Jap. Bot.* **52**: 278, f. 2 (1977). Type: China, Yunnan, Papien R., Shih-Ping, x.1898, *Henry* 13242 (K!, holotype).

Icon: Fig. 14.

Shrub c. 1 m tall, with stems erect or arching, without or with a few short lateral branches. *Stems* 4-lined and ancipitous when young, soon unlined, eventually terete; internodes 25–70 mm long, mostly exceeding the leaves; bark reddish-brown. *Leaves* all sessile or the lower (or rarely all but uppermost) with flat petiole to 1·5 mm long; lamina (30–)37–75 × (10–)15–44 mm, oblong-lanceolate or oblong-ovate to broadly ovate, acute to rounded-apiculate, margin plane, not or scarcely incrassate, base rounded to subcordate, the upper amplexicaul, paler and ± glaucous beneath,

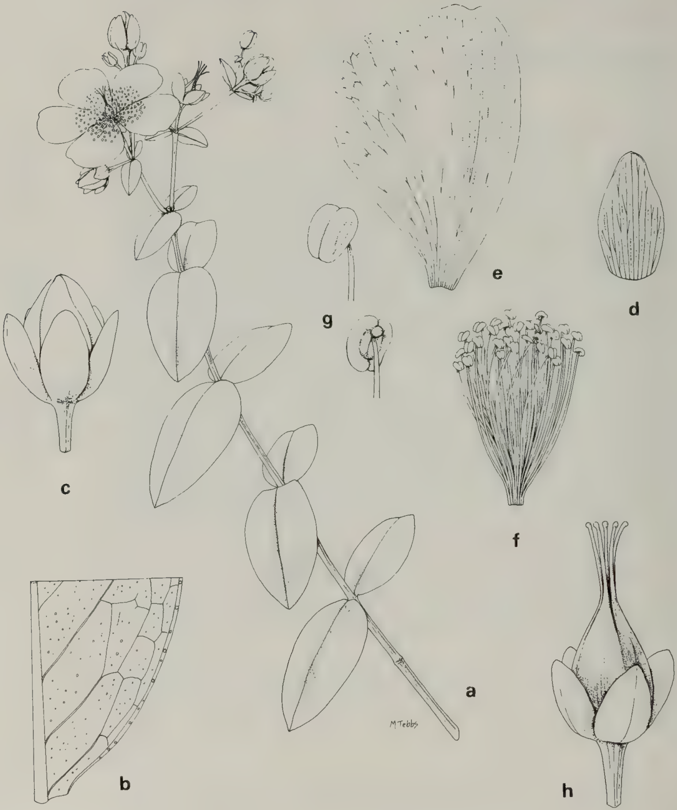
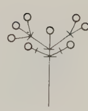


Fig. 14 *H. augustinii*: (a) habit; (b) leaf section; (c) flower bud; (d) sepal; (e) petal; (f) stamen fascicle; (g) anthers; (h) capsule (a × 1; b–f, h × 4; g × 40). All *Yeo* s.n.



coriaceous; venation: 3 pairs main laterals, with midrib branched distally, without visible tertiary reticulum; laminar glands long streaks and dots; ventral glands dense. *Inflorescence* (1) 3–13-flowered, from 1–2 nodes, subcorymbiform, with short or very short terminal internode, without branches below; pedicels 6–12 mm long; bracts on main stem broadly ovate, usually forming a pseudo-whorl, others reduced, broadly ovate to lanceolate, deciduous. *Flowers* 40–66 mm in diam., stellate to subcyathiform; buds broadly ovoid, obtuse. *Sepals* (7–)10–15 × 4–9 mm, free, imbricate, subequal to unequal, erect in bud, ± spreading in fruit, ± broadly oblong to broadly elliptic or ovate, subapiculate or obtuse to rounded, with margin entire or slightly eroded towards apex; midrib distinct in outer sepals, obscure except near apex in inner ones, veins not prominent; laminar glands numerous, linear to punctiform. *Petals* pale to bright golden yellow, not tinged red, spreading or slightly incurved, 20–36 × 14–26 mm, *c.* 2·5–3 × sepals, obovate, with apiculus subterminal, rounded or almost absent; margin entire or very minute denticulate, eglandular. *Stamen fascicles* each with 60–70 stamens, longest 10–20 mm long, *c.* 0·5 × petals; anthers golden yellow. *Ovary* 5–6 × 4–5 mm, broadly ovoid; styles 6–8 mm long, *c.* 1·2 × ovary, erect to gradually divergent, outcurved towards apex; stigmas capitate. *Capsule* 10–12 × 9–10 mm, broadly ovoid. *Seeds* dark reddish-brown, *c.* 1·5 mm, long cylindric, not or scarcely carinate, shallowly linear-reticulate. 2n = *c.* 54.

Collected at 1200–1890 m.

China (southern Yunnan). Map 10.

CHINA. Yunnan: Papien R., Shih-Ping, 1200 m, x.1898, *Henry* 13242 (K); Shiping, 1700 m, 12.iii.1959, *Wu* 868 (KUN); Kunyuan, 1890 m, 10.i.1963, *Zhang* 100365 (KUN); Kunmingshan, Mekong R., Kengbung [Cheli], 1866 m, 1935, *Wissmann* 1172 (W).

CULTIVATED. Specimens seen from England (1923–1983), Eire (1967), and the Channel Islands (Jersey, 1970).

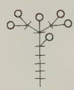
H. augustinii, a local species from the extreme south of Yunnan, is related to *H. pachyphyllum* (from eastern Burma). It is a stout plant with large, coriaceous leaves and large flowers, characters which may be a result of polyploidy. It has not proved possible yet to obtain a consistent chromosome number. The numbers so far counted, which range from 48 to 55, suggest that *H. augustinii* may be a hexaploid on the base x = 9 (i.e. 2n = 54). In Europe, the species flowers too late in the season to allow fruits to develop.

8(19). **Hypericum williamsii** N. Robson

in *J. Jap. Bot.* **52**: 279, f. 2 (1977); in Hara & Williams, *Enum. fl. pl. Nepal* **2**: 63 (1979). Type: Nepal (West), Poyora, 2850 m, 28.vii.1952, *Polunin, Sykes & Williams* 354 (BM!, holotype).

Icon: —.

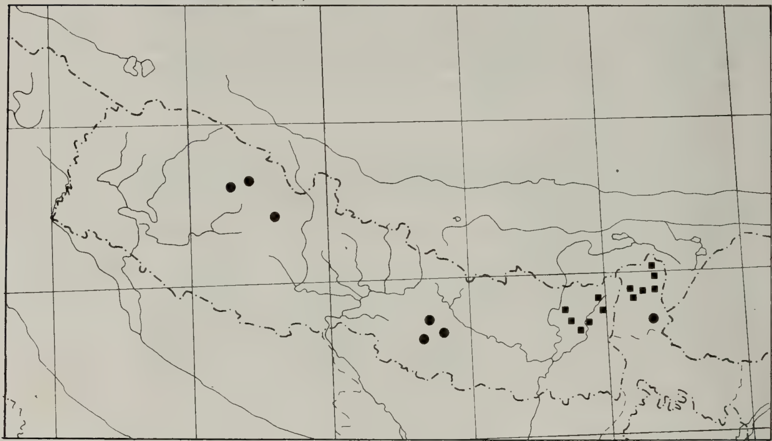
Shrub 0·7–1·3 m, tall, bushy, with branches ascending, not frondose. *Stems* orange-brown, 2-lined when young, soon terete; internodes 10–20 mm long, shorter than to slightly exceeding leaves; bark grey-brown. *Leaves* petiolate, with petiole 0·5–2 mm long; lamina 20–49 × 8–24 mm, lanceolate or ovate-oblong to ovate, obtuse to rounded, apiculate, margin plane, not incrassate, base cuneate-angustate to rounded, glaucous beneath, chartaceous; venation: 3–4 pairs main laterals, the midrib branched distally, with scarcely visible lax tertiary reticulum; laminar glands streaks and dots; ventral glands dense. *Inflorescence* 1–7(–16)-flowered, from 1(2) node(s), corymbiform, usually with short apical internode, without flowering branches from middle of current stem; pedicels 3–6 mm long; bracts lanceolate, acute, deciduous. *Flowers* 30–40 mm in diam., shallowly cyathiform; buds broadly ovoid, obtuse. *Sepals* 6–9 × 3–5·5 mm, free, imbricate, subequal, ascending in bud and fruit, oblong to elliptic-oblong, rounded or more rarely apiculate-obtuse, with margin entire or minutely denticulate, hyaline; midrib of outer sepals ± distinct, veins not or slightly prominent; laminar glands linear, numerous. *Petals* bright yellow, not tinged red, slightly incurved, 15–20 × 13–15 mm, *c.* 2·5 × sepals, narrowly obovate, with



apiculus lateral rounded to obscure, margin entire to subdenticulate, with a row of inframarginal gland dots. *Stamen fascicles* each with 45–70 stamens, longest 9–12 mm long, *c.* 0·6 × petals; anthers deep yellow. *Ovary* 6–7 × 4·5–5·5 mm, ovoid to ellipsoid-ovoid; styles 5·5–7 mm long, 0·9–1 × ovary, erect, outcurved towards apex; stigmas slightly capitate. *Capsule c.* 13 × 9–10 mm, ± broadly ovoid. *Seeds* not seen. 2n = ?

On rocky or grassy slopes, often in shade; 1800–2850 m.

Sikkim, Nepal (two areas: 82°–83°E and around 85°15′E). Map 11.
SIKKIM. Gangtok, between Orchid Sanctuary and Rumtok, Martam, 1800 m, 27.vi.1969, *Hara, Kurosawa & Ohashi* T. 701000 (TI).
NEPAL. Central: Leyley Deorali, 1800 m, 12.vii.1967, *Manandhar* 7106 (BM, KATH). West: Bheri Valley, near Tarakot, 2610 m, 27.vi.1952, *Polunin, Sykes & Williams* 2320 (BM).



Map 11 Sect. 3. *Ascyreia*: 8. *H. williamsii* ●, 9. *H. tenuicaule* ■.

H. williamsii is related to *H. pachyphyllum* and *H. augustinii*, having the same erect habit and elliptic-oblong to oblong sepals; but the leaves are broader below the middle and petiolate. In some respects (e.g. longer stamens and usually entire sepals and petals) it is nearer to *H. augustinii* than is *H. lobbii*, but the thinner sepals with a hyaline margin and the obtuse flower buds are more advanced characters.

9(20). **Hypericum tenuicaule** Hook. f. & Thomson ex Dyer

in Hook. f., *Fl. Brit. Ind.* **1**: 254 (1874); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925); N. Robson in Hara & Williams, *Enum. fl. pl. Nepal* **2**: 62 (1979). Type: Sikkim, Lachen valley, 2400 m, 3.viii.1849, *J. D. Hooker* (K!, holotype; BM!, L!, isotypes).

H. patulum subsp. *hookerianum* var. *tenuicaule* (Hook. f. & Thomson ex Dyer) Kuntze, *Rev. gen. pl.* **1**: 60 (1891).

Norysca urala var. *angustifolia* Y. Kimura in Hara, *Fl. eastern Himal.*: 210 (1966) pro parte, incl. typum. Type: Nepal, Yamphodin to Ghatte, 2100–1600 m, 18.xi.1963, *Kanai, Murata & Togashi* T.6304573 (TI!, holotype).

Icon: —.

Shrub c. 1·5 m tall, bushy, with branches ascending to arching, not frondose. Stems red, 4-lined when young, soon terete; internodes 8–14 mm, shorter than leaves; bark reddish-brown to grey-brown. Leaves petiolate, with petiole 0·5–2 mm long; lamina 15–58 × 4–19 mm, lanceolate to rarely elliptic, acute to rounded, not or scarcely apiculate, margin plane or rarely undulate, not incrassate, base cuneate to angustate, ± glaucous beneath, chartaceous; venation: 2–3 pairs main laterals, with midrib branched distally, without visible tertiary reticulum; laminar glands streaks and dots; ventral glands dense. *Inflorescence* 1–4(–7)-flowered, from 1(2) node(s), corymbiform, with short (sometimes very short) apical internode, without flowering branches from middle of current stem; pedicels 9–15 mm long; bracts squamiform, acute, deciduous. *Flowers* 15–30 mm in diam., ± deeply cyathiform; buds subglobose, obtuse to rounded. *Sepals* 4–5 × 1·8–2·3 mm, free, subimbricate, equal, erect in bud and fruit, oblong to oblong-spathulate, rounded or rarely with minute apiculus, with margin entire or minutely eroded-denticulate (and then hyaline); midrib obscure or indistinct, veins not prominent; laminar glands linear, numerous. *Petals* bright yellow, sometimes tinged red, ± incurved, 10–13 × 8 × 12 mm, *c.* 2·5 × sepals, obovate to subcircular, with apiculus subterminal, rounded or almost absent; margin entire, with or without a few intramarginal or marginal gland dots. *Stamen fascicles* each with 30–35 stamens, longest 5–7 mm long, *c.* 0·5 × petals; anthers bright yellow. *Ovary* 4–5 × 2·5–4 mm, ovoid; styles 3·5–6 mm long, 0·9–1·2 × ovary, erect, straight or outcurved very near apex; stigmas small. *Capsule* 8–11 × 4–7 mm, ± broadly ovoid. *Seeds* dark brown, 0·7–0·8 mm, cylindric, not carinate, shallowly linear-foveolate. 2n = ?

On 'rocky bank under trees' (*Beer, Lancaster & Morris* 9493); 1300–3150 m.

Sikkim, Nepal (east). Map 11.

SIKKIM. Kulhait, 2100 m, 11.x.1870, *Clarke* 13013B (K).

NEPAL. East: Zongi to Iladanda, 12.xi.1963, *Kanai, Murata & Togashi* T. 6304580 (BM, TI); between Tudam and Chyamtang, 3150 m, 12.xi.1971, *Beer, Lancaster & Morris* 10734 (BM).

CULTIVATED. Specimens seen from England (1975), grown from seed ex *Beer, Lancaster & Morris* 238 (Nepal (East): Bagang Khola).

H. tenuicaule resembles *H. williamsii*, but differs in its more delicate habit with narrower, not or scarcely apiculate leaves and small flowers on longer pedicels. The areas of these two species overlap in Sikkim only; *H. tenuicaule* occupies the 'gap' in the distribution of *H. williamsii* between Sikkim and the Khatmandu region. It seems clear that *H. tenuicaule* is derived from *H. williamsii*, or they have had a common ancestor; but even in Sikkim they are apparently always mutually distinguishable.

H. tenuicaule has, however, been confused with *H. uralum*; these sympatric species can always be differentiated by habit, stem-lines, and styles: frondose shoots, 4-lined stems, and styles 0.6–0.9 x ovary in *H. uralum*; divaricately branched shoots, terete stems, and styles 0.9–1.2 x ovary in *H. tenuicaule*. The presence of resinous glands on the underside of the leaf in the latter will immediately distinguish it from *H. hookerianum*.

10(21). **Hypericum lobbii** N. Robson

in *J. Roy. Hort. Soc.* **95**: 496 (1970); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed., **2**: 418 (1973); N. Robson in *J. Jap. Bot.* **52**: 278, f. 2 (1977). Type: cultivated in Hort. Veitch [Exeter and Chelsea] ex India, Khasia, Mufflong, coll. T. Lobb, *Herb. Hooker.* (K!, holotype).

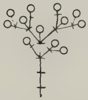
H. oblongifolium sensu Hook. f. in *Curtis's bot. Mag.* **82**: t. 4949 (1856), non Choisy (1821).

H. hookerianum sensu hort. pro parte, non Wight & Arnott (1834).

Icon: Hook. f. in *Curtis's bot. Mag.* **82**: t. 4949 (1856).

Shrub 1·2–1·5 m tall, rather compact, with branches erect (or ascending ?), not frondose. *Stems* reddish, slightly 4-angled and ancipitous when young, soon terete; internodes 10–40 mm long, shorter than to exceeding leaves; bark reddish-brown.

Leaves petiolate, with petiole 0·5–2 mm, long; lamina 20–45 × 9–25 mm, ovate-lanceolate to triangular-ovate, obtuse to rounded, apiculate, margin plane, not incrassate, base ± broadly cuneate to shortly angustate, ± glaucous beneath, subcoriaceous; venation: 2(3) pairs main laterals, with midrib branched distally, without distinct tertiary reticulum; laminar glands mostly dots (short streaks towards midrib and base); ventral glands dense. *Inflorescence* 1–16(–*c.*24)-flowered, from 1–2 nodes, corymbiform, sometimes with short apical internode, without flowering branches from middle of current stem; pedicels 4–6 mm long; bracts intermediate (below first flower), narrowly elliptic, deciduous. *Flowers* 30–50 mm in diam., shallowly cyathiform; buds ovoid, subapiculate to obtuse. *Sepals* 7–11 × 5–9 mm, free, imbricate, subequal or unequal, ± spreading in bud and fruit, ovate-oblong to broadly elliptic, rounded or usually apiculate, with margin entire or usually finely eroded-denticulate, ± hyaline, midrib of outer ones distinct, veins not prominent; laminar glands linear, numerous. *Petals* golden yellow, not tinged red, slightly incurved, 20–26 × 19–22 mm, 2·5–3 × sepals, broadly obovate, with apiculus, subterminal, rounded; margin finely glandular-denticulate, with a row of inframarginal gland dots. *Stamen fascicles* each with *c.* 50–60 stamens, longest 8–9 mm long, *c.* 0·35–0·4 × petals; anthers deep yellow. *Ovary* 5–6 × 4–4·5 mm, long, ± broadly ovoid; styles 4·5–5 mm long, 0·9 × ovary, ± erect, outcurved towards apex; stigmas subcapitate or capitate. *Capsule* 9–12 × 7–9 mm, ovoid. *Seeds* not seen. 2n = ?



Habitat unknown; 1800–3600 m.

India (Meghalaya). Map 10.
INDIA. Meghalaya: Khasi Hills, *Kurz* 285 (BO, E).
CULTIVATED. Specimens seen from England (1853–1882), Germany (1886), and U.S.A. (California) (1915).

H. lobbii appears to be a very local plant of the Khasi Hills. It is well described and illustrated by J. D. Hooker (see above) from a cultivated plant, but seems to have almost died out in Europe subsequently. Recent specimens that were thought to belong to it have nearly all turned out to be *H. forrestii*. The tendency for the sepals to spread is not so marked as in the next species, *H. gracilipes* (see Hooker's illustration), which is why confusion can occur with *H. forrestii*. The latter species, however, has leaves that are not apiculate, sepals erect in bud and fruit, petals entire, and stamens 0·4–0·6 × petals.

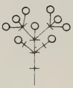
H. lobbii is related to *H. williamsii*, from which it can be distinguished by the spreading and usually apiculate sepals, the relatively shorter stamens, the broader, denticulate petals, and the shorter ovary and styles.

11(22). **Hypericum gracilipes** Stapf ex C. Fischer

in *Kew Bull.* **1940**: 32 (1940) [Parry, *Lakhers*: 587 (1932), nomen]. Type: India, Mizoram, Lushai Hills, Neikdawn, 1200 m, vii.1926, *Mrs N. E. Parry* 74 (K!, holotype).

Icon: —.

Shrub, c. 0·5 m tall, 'undershrub', with branches erect, not frondose. *Stems* reddish, slightly 4-angled and ancipitous when young, soon terete; internodes 20–70 mm long, shorter than to much exceeding leaves; bark grey-brown. *Leaves* petiolate, with petiole 0·5–2 mm long; lamina (15) 23–60 × (6)9–25 mm, ovate to lanceolate, acute to obtuse or rounded-apiculate, margin plane, not incrassate, base narrowly to broadly cuneate or shortly angustate, ± glaucous beneath, chartaceous; venation: 2(3) pairs main laterals, with midrib obscurely branched distally, usually without distinct tertiary reticulum; laminar glands dots and sometimes a few short streaks, ventral glands dense. *Inflorescence* 3–10-flowered, from 1–3 nodes, corymbiform, with short apical internode, without flowering branches from middle of current stem; pedicels 5–10 mm long; bracts linear-lanceolate to linear, deciduous. *Flowers* 25–35 mm in diam., cyathiform; buds ± narrowly ovoid, acute or subacuminate. *Sepals* 5–9 × 1–3(4) mm, free, subimbricate or open, subequal, ± spreading in bud and fruit, narrowly elliptic to linear-oblong, acute to acuminate, with margin entire; midrib



usually distinct, veins not prominent; laminar glands linear or interrupted, 4–10. *Petals* golden yellow ?, not tinged red, ± incurved, 2–18 × 19–15 mm, *c.* 2–3 × sepals, broadly obovate, with apiculus subterminal, rounded; margin very finely glandular-denticulate (or entire ?), with a few inframarginal gland dots. *Stamen fascicles* each with *c.* 50 stamens, longest 5–6 mm long, *c.* 0·25–0·35 × petals; anthers deep yellow. *Ovary* 3·5–5 × 2–3 mm, ovoid to ellipsoid; styles 3–4 mm long, *c.* 0·8 × ovary, suberect, outcurved towards apex; stigmas subcapitate. *Capsule* 9–13 × 5–7 mm, ellipsoid. *Seeds* dark reddish-brown, *c.* 1 mm long, cylindric to ovoid-cylindric, scarcely carinate, very shallowly linear-reticulate. 2n = ?

Shaded (sandstone) banks and streamsides; 1200–2250 m.

Bangladesh (Chittagong), India (Mizoram, Manipur, Nagaland, west Bengal). Map 10.

BANGLADESH. Chittagong: Chittagong Division, *Cowan* (E).

INDIA. Mizoram: Lushai Hills, N. Vaulaiphai, 1500 m, xii.1927, *Parry* 62a (K). Manipur: Sirhoi, 1800 m, 16.vii.1948, *Kingdon Ward* 17794 (BM). Nagaland: Kedima, 1800 m, 20.vii.1935, *Bor* 6313 (K). West Bengal: Darjeeling, Ghum to Lopchu, 2100 m, 19.vi.1960, *Kenai, Murata & Togashi* 2947 (K); Ghum, 2250 m, 4.vii.1919, *Cave* (E).

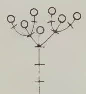
H. gracilipes is like a small, scrubby version of *H. lobbii*, differing in size of flower, in the much narrower, acute sepals and in the narrower and usually smaller leaf (*Bor* 6313 has large leaves – to 60 × 25 mm). The habit becomes scrubbier and the parts smaller (in general) northwards, the plants from near Darjeeling being rather like *H. uralum* apart from the narrow, acute sepals and non-frondose habit. They have been included in *H. gracilipes* here, but study of further material may show them to be taxonomically distinct.

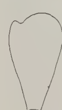
12(23). **Hypericum gaitii** Haines

in *J. & Proc. asiat. Soc. Beng.* II, **15**: 311, t. 10 (1920). Type: India. Bihar, on the plateau ('pats') of Chota Nagpur, Neterhat, v.1918, *Haines* 4327 (K!, holotype).

Icon: Haines in *J. & Proc. asiat. Soc. Beng.* II, **15**: 311, t. 10 (1920).

Shrub 0·7–1·5 m tall, bushy, with branches erect to ascending. *Stems* red to yellow-brown, 4-lined and ancipitous when young, soon terete; internodes *c.* 10–40 mm long, shorter than leaves; bark grey-brown. *Leaves* sessile; lamina 30–90 × 8–30 mm, elliptic or oblong-elliptic to oblanceolate, acute to obtuse-apiculate, margin plane, base cuneate, paler beneath, ± glaucous, subcoriaceous to chartaceous, lower ones eventually deciduous; venation: 3(4) pairs main laterals, branched, the midrib pinnately branched, with tertiary reticulum rather dense and visible beneath; laminar glands very short streaks and small dots; ventral glands absent. *Inflorescence* (1)3–7-flowered, from apical node, subcorymbiform; pedicel 4–25 mm long (in fruit); bracts foliar (persistent) to small, elliptic (deciduous). *Flowers* (20–)40–55(–65) mm in diam., stellate; buds ovoid ?, subacute ? *Sepals* (6–)9–13 × 4–6 mm, free, imbricate, subequal, erect in bud and fruit, ovate-lanceolate to narrowly elliptic, acute to rounded, margin entire or irregularly and minutely denticulate, midrib obscure; other veins not prominent; laminar glands linear to striiform, numerous. *Petals* bright yellow, not tinged red, spreading, 25–30 × 15–20 mm, 3–4 × sepals, narrowly obovate, with apiculus subterminal, rounded; margin entire, eglandular. *Stamen fascicles* each with *c.* 30 stamens, longest 15–18 mm long, *c.* 0·5–0·65 × petals; anthers yellow. *Ovary* 6–8 × 4–5 mm, ovoid; styles 10–12 mm long, 1·5–1·7 × ovary, free, suberect with apex outcurved; stigmas small. *Capsule* 13–17 × 7–9 mm, narrowly ovoid-conic. *Seeds* dark reddish-brown, 10–12 mm long, cylindric, slightly carinate, shallowly linear-foveolate to almost ribbed-scalariform. 2n = ?





In shade on cliffs and along streams; 900–1560 m.

India (Bihar, Orissa). Map 8.

INDIA. Bihar: Netarhat, 900 m, v.1918, *Haines* 4327 (K); Surguja State, Nawadih, 1110 m, 10.v.1940, *Mooney* 1298 (K); Surguja State, Mainpat, 24.v.1938,

Mooney 780 (K). Orissa: Pal Lahara State, Malyagiri Hill, 1140 m, 12.vi.1937, *Mooney* 458 (K); Koraput Distr., near Pottangi, Turia Konda, 1410–1560 m, 10.x.1950, *Mooney* 4077 (K).

H. gaitii, which was described by Haines as intermediate between *H. mysurense* and *H. cernuum* (i.e. *oblongifolium*), is indeed both morphologically and geographically intermediate between these species, having a scattered distribution in areas of high ground in the north-east of peninsular India. It is separated from the areas of *H. mysurense* by the dry region of the Deccan and from that of *H. oblongifolium* by the Ganges valley. As the high ground in the south of Orissa continues into Andhra Pradesh, *H. gaitii* may well occur in that province. It is also related to *H. monogynum* (q.v.), which is geographically separated from it, not only by the Ganges Valley, but also by the Himalayan massif and the Tibetan plateau. *H. gaitii* differs from *H. mysurense* by the stem internodes, which are longer and soon terete, by the larger leaves with more densely reticulate venation and by the longer narrower sepals, rounded petal apiculus, relatively shorter styles and larger capsule. From *H. oblongifolium* it is distinguished by the narrower leaves, larger sepals erect in bud and fruit, relatively shorter stamens, relatively shorter styles and narrower capsule.

13(24). **Hypericum oblongifolium** Choisy

Prodr. monogr. fam. Hypéric.: 42, t. 4 (1821); in DC., *Prodr. syst. nat. regni veg.* **1**: 545 (1824); N. Robson in *J. Roy. Hort. Soc.* **95**: 489 (1970), in K. H. Rechinger, *Fl. iranica* **49**: 4 (1968); in Nasir & Ali, *Fl. W. Pakistan* **32**: 3, f. 1 I–L (1973), in Hara & Williams, *Enum. Fl. Pl. Nepal* **2**: 62 (1979). Type: 'Ex Indiis orientalibus', [*Hardwicke* ?] (G-DC, holotype!; BM!).

Hypericum sp. sensu Hardwicke in *Asiatick Researches* **6**: 369 (1801).

H. cernuum Roxb. [*Hort. Bengal.*: 59 (1814) nomen] ex D. Don., *Prodr. fl. nepal.*: 218 (1825); Roxb., *Fl. indica* **3**: 400 (1832); Cambess. in Jacquem., *Voy. Inde* **4**: 30, Atlas **2**: t. 33 (1844); Dyer in Hook. f., *Fl. Brit. Ind.* **1**: 253 (1874); Collett, *Fl. simlensis*: 555 (1902); Banerji in *J. Bombay Nat. Hist. Soc.* **51**: 774 (1953), in *Rec. Bot. Surv. Ind.* **19**(2): 27 (1966). Type: India, cult. ex Kashmir, 'Between Burdwar and Shreenagar', seed ex Hardwicke, 1797, *Roxburgh* (CAL, holotype).

H. speciosum Wallich, *Numer. list*: No. 4803 (1831), nomen.

Norysca cernua (Roxb. ex D. Don) J. Voigt, *Hort. suburb. Calcutta*: 90 (1845); K. Koch, *Hort. dendrol.*: 66 (1853); Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856).

Norysca oblongifolia (Choisy) Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856) pro parte, excl. syn. *H. uralum, H. patulum*; Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 102 (1951).

H. patulum var. *oblongifolium* (Choisy) Koehne, *Deutsch. Dendr.*: 415 (1893) pro parte quoad typum.

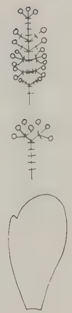
H. aitchisonii J. R. Drumm. ex R. Keller in *Bot. Jahrb.* **58**: 191 (1923) in synon.; R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925), nomen.

H. cernuum var. *typicum* R. Keller in *Bot. Jahrb.* **58**: 191 (1923), in synon.

H. cernuum var. *lanceolatum* R. Keller in *Bot. Jahrb.* **58**: 191 (1923), in synon.

Icon: Choisy, *Prodr. monogr. fam. hypéric.*: t. 4 (1821).

Shrub 0·45–1·2(–2·4) m tall, much branched, with branches spreading or drooping, sometimes straggling or semi-scandent. *Stems* red, 4-lined and ancipitous when young, soon terete; internodes 15–50 mm long, shorter than or rarely exceeding leaves; bark grey. *Leaves* sessile; lamina 30–93 × 10–42 mm, elliptic to oblong or ovate-oblong, obtuse or apiculate to rounded, margin plane, base cuneate to rounded, paler beneath, sometimes glaucous, chartaceous, lower ones eventually deciduous; venation: 3–4(5) pairs main laterals, branched, the midrib pinnately branched, with tertiary reticulum lax to dense, conspicuous; laminar glands short lines or streaks or dots in the reticular areolae; ventral glands dense to sparse. *Inflorescence* 1–3(–8)-flowered, from apical node, corymbiform, sometimes also on short lateral shoots from up to *c.* 16 nodes towards base of current growth, then cylindric-ellipsoid; pedicels 4–20 mm long; bracts intermediate, persistent to small,



lanceolate, deciduous. *Flowers* 35–65(–75) mm, in diam., stellate; buds ovoid, obtuse to rounded. *Sepals* 5–8 × 2·5–5 mm, free, imbricate, subequal to somewhat unequal, erect in bud, ± ascending in fruit, narrowly ovate to elliptic-oblong, acute to rounded, margin entire or sometimes minutely denticulate near apex; midrib obscure but apex sometimes incrassate, other veins not prominent; laminar glands numerous, linear. *Petals* bright yellow to bright yellow-orange, not tinged red, spreading, 20–30 × 10–16 mm, *c.* 4 × sepals, obovate to oblanceolate, with apiculus lateral, rounded, margin entire, eglandular. *Stamen fascicles* each with *c.* 30 stamens, longest 15–20 mm long, *c.* 0·7 × petals, anthers yellow. *Ovary* 4–7 × 3–5·5 mm, ovoid-pyramidal to broadly ovoid; styles 9–14 mm long, *c.* 2–3 × ovary, free, erect or slightly apically outcurved; stigmas small to subcapitate. *Capsule* 9–17 × 7–11 mm, ovoid to ovoid-conic. *Seeds* dark reddish-brown, 1–1·2 mm long, cylindric or cylindric-ovoid, narrowly carinate, very shallowly linear-foveolate to ribbed-scalariform. 2n = 24, 44, 46, 48.

In damp or sheltered cliff crevices, in thickets or *Quercus* forest, or on grassy or stony hillsides; (600)750–2700 m.

Pakistan (north), India (Kashmir to Kumaun), Nepal (west, central). Map 12.

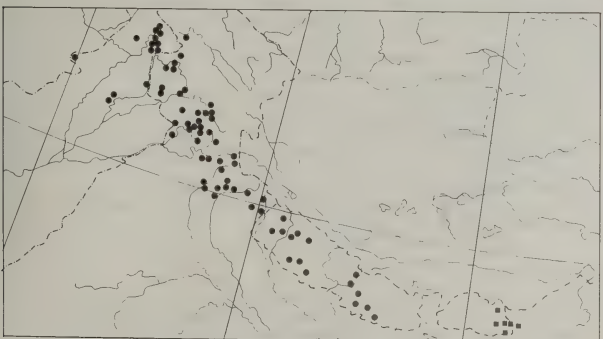
PAKISTAN. Kurram: Kurram Valley near Kurram, iv.1879, *Aitchison* 65 (DD, K). Swat: Swat, iv.1949, *Herb. Stewart.* 70 (RAW), Hazara: Kagan, Malkandi, 1350 m, 20.v.1897, *Duthie* (K, RAW). Rawalpindi: Murree, Brewery Estate near Octrol, 8.v.1975, *Dar, Amin & Safraz Khan* 494 (BM). Jhelum: Shahpur, Salt Range, Sakesar, 7.iv.1902, *Drummond* 13820 (E, K). Azad Kashmir: above Palandri, 1440 m, 13.iv.1969, *Ali & Nasir* 5481 (RAW).

INDIA. Kashmir: Jelum Valley, Uri, 1200 m, *Ludlow & Sherriff* 7588 (BM). Himachal Pradesh: Kangra, Bhadwar, 600 m, 6.v.1933, *Koelz* 4405(A); Simla, Ushan Valley, 1260 m, 25.iv.1888, *Watt* 8886(E). Uttar Pradesh: Mussoorie, Song Khad, 1920 m, 5.v.1948, *Fleming* 427(A); Garhwal, Westufer des Naini Tal, 2100 m, 8.v.1961, *Kräusel* (FR).

NEPAL. West: Tila Valley, Kalikot, 1650 m, 20.iv.1950, *Polunin, Sykes & Williams* 1929 (BM, L). Central: Ganesh Himal, Gatlang, 1950 m, 26.iv.1952, *Stainton* 3627 (BM, E).

CULTIVATED. Specimens seen from England ex Kashmir, Srinagar (1983).

Despite the recorded variation in chromosome number from diploid (2n = 24) to tetraploid (2n = 44, 46, 48), morphological variation in *H. oblongifolium* does not appear to be great. Stem and leaves tend to be more glaucous and parts somewhat smaller towards the western (drier) end of its range, but there is no evidence of morphological discontinuity. It is separated geographically from its nearest relatives



Map 12 Sect. 3. *Ascyreia*: 13. *H. oblongifolium* ●, 15. *H. griffithii* ■.

by disjunctions of varying size, viz. to the south of the Ganges Valley (*H. gaitii*), to northern Turkey (*H. calycinum*) and to Bhutan (*H. griffithii*).

Although Hardwicke (1801) collected this species from 'between Dosay and Bedeyl' in 1796 and sent seed to Calcutta Botanic Garden in 1797 from 'between Hurdwar and Shreenagur [Srinagar]', Roxburgh named it *H. cernuum* only in 1814 and did not himself provide a valid description until 1832, by which time David Don (1825) had validated this name. Meanwhile, Choisy (1821) had described a specimen sent from Herb. Lambert (BM) to Geneva in 1816 as *H. oblongifolium*. This specimen is annotated 'Nidas' or 'Sides'. This could well be 'Sides', because *Hardwicke* 4 (BM) is labelled 'Sides of high Mountains'. The BM specimen is thus likely to be part of the type collection.

14(25). **Hypericum calycinum** L.

Mant. pl. **1**: 106 (1767); Curtis, *Bot. Mag.* **5**: t. 146 (1796); J. E. Sm., *Eng. Bot.* **29**: t. 2017 (1809), in *Trans. Linn. Soc. Lond.* **10**: 266 (1811); Choisy, *Prodr. monogr. fam. Hypéric.*: 42 (1821); in DC., *Prodr. syst. nat. regni veg.* **1**: 546 (1824); Sibthorp & Lindley, *Fl. graeca* **8**: 52, t. 771 (1833); Treviranus, *In Hyper. gen. spec. animadv.*: 8 (1861); Boissier, *Fl. orient.* **1**: 789 (1867); Britten in *J. Bot., Lond.* **53**: 68 (1915); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925); Stefanoff in *God. Agr.-les. Fak. Univ. Sofiya* **11**: 143 (1933), in *Pflanzenareale*: Karte 2a (1933); Czeczott in *Mitt. Königl. Naturwiss. Inst.* **10**: 59, f. 14 (map) (1937); Gorshkova in Shishkin & Bobrov, *Fl. U.R.S.S.* **15**: 211 (1949); Milano in *Publs. Inst. bot. agric. Argentina* **8** (128): 16, f. 4 (1961); Salisbury in *Watsonia*, **5**: 368 (1963); Yakar, *Renk. Turk. Bitk. Atlasi* **2**: t. 30 (1965); N. Robson in Davis, *Fl. Turkey* **2**: 365, map 20 (1967), in Tutin et al., *Fl. europaea* **2**: 263 (1968), in *J. Roy. Hort. Soc.* **95**: 489 (1970); Jordanov & Kožuharov in Jordanov, *Fl. Rep. Pop. Bulg.* **4**: 229, t. 43 f. 2 (1970); [Lancaster], *Hillier's man. trees & shrubs*: 150 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 410 (1973). Type: Turkey or cultivated ('Habitat in America septentrionalis', lapsus calami), *Herb. Linn.* 943/7 (LINN!, lectotype); ex Herb. Cliff., *Herb. Linn.* 943/6 (LINN!, syntype).

H. ascyron sensu Miller, *Gard. dict.* 7th ed.: no. 7 (1759) 8th ed.: no. 7 (1768), non L. (1753).

Ascyron coriaceum Moench, *Meth. bot.*: 130 (1794), nom. illegit. Type as for *H. calycinum* L.

H. venosum Lam., *Encycl. méth.* (Bot.) **4**: 146 (1797). Type: *Herb. Juss.* (P).

H. grandiflorum Salisb., *Prod. stirp. horto Chapel Allerton*: 369 (1798), nom. illegit. Type as for *H. calycinum*.

H. calycinum var. β sensu Choisy, *Prodr. monogr. fam. Hypéric.*: 43 (1821).

Ascyrum calycinum (L.) Poiret, *Tabl. encycl. méth.* **3**: 199, t. 642 ff. 1–22 (1823) ('*calicinum*').

H. calycinum var. *acutifolium* Choisy in DC., *Prodr. syst. nat. regn. veg.* **1**: 546 (1824). Type: 'Hyper. florib.', 1807, *Herb. Montbret.* ? (G-DC!).

Eremanthe calycina (L.) Spach, *Hist. nat. vég.* Phan. **5**: 422 (1836), in *Annls Sci. nat.* (Bot.) II, **5**: 363 (1836); K. Koch, *Hort. dendrol.*: 65 (1853).

Androsaemum calycinum (L.) C. Presl ex Steudel, *Nomencl. bot.* 2nd ed. **1**: 94 (1840); Clemoncet in *Bull. Ass. Nat. Vallée Loing Massif Fontainebleau* **42**: 13 (1966).

Eremanthe venosa (Lam.) K. Koch, *Hort. dendrol.*: 65 (1853).

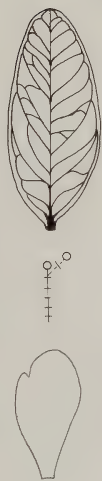
Norysca calycina (L.) Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856); Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 98 (1951).

Norysca venosa (Lam.) Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856).

Icon: Curtis, *Bot. Mag.* **5**: t. 146 (1796).

Shrub 0·2–0·6 m tall, evergreen, with creeping branching stolons and erect, usually unbranched stems. *Stems* brownish-orange to red, 4-lined, ancipitous when young; internodes 20–60 mm long, shorter than leaves; bark grey. *Leaves* subsessile or with petiole up to 2 mm long; lamina 45–95(–104) × 15–39(–45) mm, oblong to elliptic or

± narrowly ovate, obtuse to apiculate, margin plane, base cuneate to rounded, paler beneath, not glaucous, coriaceous, lower ones eventually deciduous; venation: 3–4 pairs main laterals, not clearly distinct from midrib branches, with tertiary reticulum dense, conspicuous especially beneath; laminar glands very short streaks or dots in the reticular areolae; ventral glands absent. *Inflorescence* 1(2–3)-flowered; pedicels absent or 10–12 mm long; bracts small, lanceolate, persistent. *Flowers* 50–80(–95) mm in diam., stellate; buds broadly ovoid to globose, rounded. *Sepals* 10–20 × 7–15 mm, free, imbricate, markedly unequal, erect in bud, ± ascending in fruit, broadly elliptic to subcircular or obovate, ± cucullate, margin entire or minutely and remotely denticulate, midrib not distinct, veins not prominent; laminar glands linear, distally dissected, numerous. *Petals* bright yellow, not tinged red, spreading, 25–40 × 13–22 mm, 2–2·5 × sepals, obovate to oblanceolate, with apiculus lateral, rounded, margin entire or minutely and remotely denticulate, eglandular. *Stamen fascicles* each with 90–120 stamens, longest 20–30 mm long, *c.* 0·75 × petals; anthers red. *Ovary* 5–9 × 3·5–6·5 mm, ovoid to ovoid-conic; styles (5 or rarely 4) 12–20 mm long, 1·5–3 × ovary, free, erect or spreading; stigmas small. *Capsule* 10–20 × 10–13 mm, ovoid to ovoid-conic. *Seeds* reddish-brown, 1·5–2 mm long, cylindric, not or narrowly carinate, shallowly linear-reticulate to -foveolate. 2n = 20.

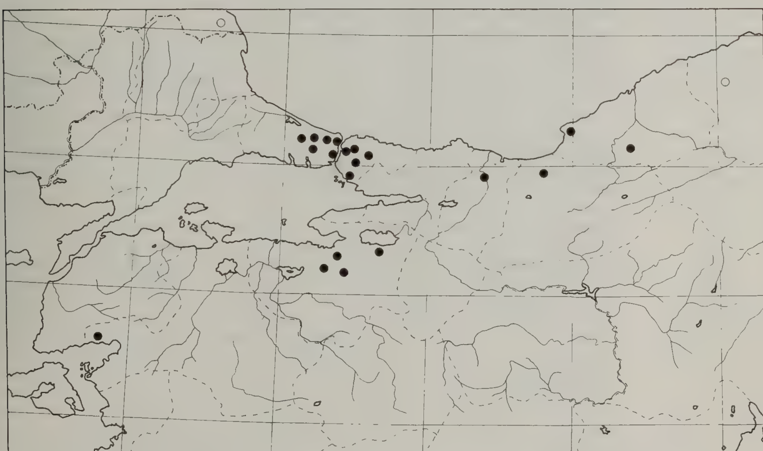


In shady woods (especially *Quercus* and *Fagus*) and on dry or damp shaded banks; 30–1200 m.

Bulgaria (south-east), Turkey (north, along the Black Sea eastward to Trabzon). Widely cultivated and often naturalised. Records from west Transcaucasia (e.g. by Ledebour, Boissier, and Gorshkova) are apparently based on introductions. Map 13.

BULGARIA. Burgas: Strandzha Mts, 100 m, (fide *Fl. Rep. Pop. Bulg.*)

TURKEY. Kirklareli: Strandscha-dagh [Instranca daglari], *c.* 100–500 m, 5.vii.1927, *Mattfeld* 3443 (A). Istanbul: (Europe) Sariyer, 21.vi.1953, *Baytop* 2761 (BM, H); (Asia) Polonesköy, 7.ix.1939, *Post* (G-P). Kocaeli: Marmara Sea between Izmit and Yalova, 14.ix.1957, *K. H. Rechinger* 15333 (W). Bursa: Mt Olympus [Ulu dağ] supra Brussa [Bursa], 200 m, 21.v.1899, *Bornmüller* 4232 (E); Ulu dağ, 2.vii.1972, *Himmetoğlu* H8 (BM). Balikesir: Mt. Ida [Kaz dağ] circa font. Scamandri, 29.vii.1883, *Sintenis* 407 (A, BM, E, G, JE, K, S, U). Sakarya: Karasu to



Map 13 Sect. 3. *Ascyreia*: 14. *H. calycinum* ●, ○ (unlocalised); also in vil. Trabzon (see Map 33).

Söğütlu, 30 m, 7.viii.1962, *Davis & Coode* D. 39087 (E, K). Bolu: Düzce to Akcakoca, 320 m, 14.vii.1962, *Davis & Coode* D. 38517 (E, K). Zonguldak: 9 km S. Devrek, *c.* 300 m, 8.vi.1962, *Sorger* T62/85/1 (E). Kastamonu: between Inebolu and Bolu, *Bernhard* (fide *Fl. Turkey*). Trabzon: Bender Erekli, *Handel-Mazzetti* (fide *Fl. Turkey*).

CULTIVATED. Specimens seen from the British Isles (all countries), France, Germany, Switzerland, Austria, Sweden, Finland, U.S.A.

NATURALISED. Specimens seen from the British Isles (all countries), France, Italy, Yugoslavia (Istria), Greece, U.S.S.R. (Krym, Georgia). Recorded from Argentina.

H. calycinum is a popular species in cultivation because it tolerates dry shady conditions, although it flowers better in more open situations. Its flower is one of the largest in the genus. It was first introduced into England from near Istanbul (probably from the Belgrade Wood) by Sir George Wheeler in 1676 and soon escaped from cultivation (Britten, 1915).

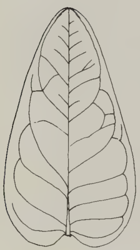
H. calycinum appears to spread by seed as well as vegetatively in its native area; but in the British Isles its reproduction is almost wholly vegetative. It is self-compatible, and Salisbury (1963) suggested that this is due to (i) degrees of failure in embryo development and (ii) inefficient endosperm nutrition before the resting stage is reached, both conditions resulting from too low temperatures during pollination and fertilisation. Likewise, the absence of sun-baking during capsule maturation would be deleterious.

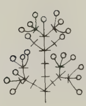
The isolation of *H. calycinum* from near relatives precludes natural hybridisation; but artificial hybrids have been made with *H. patulum* (*H.* x *moserianum* Luquet ex André, q.v.), *H. kouytchense* and *H. forrestii* (see Robson, 1981: 170), and also *H.* x *cyathiflorum*.

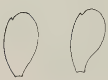
15(26). **Hypericum griffithii** Hook. f. & Thomson ex Dyer

Fl. Brit. Ind. **1**: 253 (1874); Biswas in *Bull. bot. Surv. India* **13**: 160 + f. (1973); Sahni & Naithani in *Indian Forester* **106**: 865–868 (1981); Robson & Long in *Notes Roy. bot. Gdn Edinb.* **41**: 136, f. 3 (1983). Type: Bhutan: descent to Dimree Nuddee, 1920 in 1862–1863, *Griffith* 833 = *EIC* 1820 (K!, holotype; BM!, CAL, K!, isotypes).

Icon: Biswas in *Bull. bot. Surv. India* **13**: 160 (1973).







Shrub 0·9–3 m tall, deciduous, with branches erect. *Stems* dark reddish-brown, 2-lined and subancipitous when young, soon terete; internodes 20–35 mm long, shorter than leaves; bark reddish-brown. *Leaves* sessile, amplexicaul; lamina (40–)45–117 × (27–)37–60 mm, ovate-oblong to ovate, obtuse-apiculate (or rarely acute) to rounded, margin plane, base cordate, not or scarcely paler beneath, not glaucous, chartaceous; venation: (6–)7–8(–9) pairs main laterals, branched, the midrib pinnately branched, with tertiary reticulum very dense, prominent on both sides or beneath only; laminar glands punctiform, large and small in the reticular areolae; ventral glands absent. *Inflorescence* 5–20-flowered, from apical node, subcorymbiform, sometimes also from second node and on lower short lateral shoots, the whole then pyramidal; pedicels 8–20 mm long; bracts small, lanceolate, deciduous. *Flowers c.* 35 mm in diam., stellate; buds conic, acute. *Sepals* 2·5–5 × 1·5–2 mm, free, imbricate, subequal, erect to outcurved in bud, ± spreading in fruit, ovate to lanceolate or oblong-elliptic, acute, sometimes apiculate, with apex incrassate, margin entire, midrib distinct or not, other veins not prominent; laminar glands few, striiform to punctiform. *Petals* golden yellow, not tinged red, spreading, (13–)15–20 × 6–10 mm, 5–6 × sepals, obovate to oblanceolate, with apiculus lateral, acute; margin entire, eglandular. *Stamen fascicles* each with 20–35 stamens, longest (8–)12–15 mm, 0·7–0·8 × petals; anthers yellow. *Ovary* 4–5 × 2·5 mm, narrowly ovoid to ovoid-ellipsoid; styles 8–10 mm long, 1·4–2 × ovary, free but sometimes coherent in lower half, erect, apically sometimes slightly spreading; stigmas subcapitate. *Capsule* 9–10 × 7 mm, narrowly ovoid to ellipsoid. *Seeds* dark reddish-brown, *c.* 0·9 mm long, cylindric, narrowly carinate, linear-foveolate to ribbed-scalariform. 2n = ?

On dry hillsides and in scrub jungle along river bank; (900?)1050–1920 m.

Bhutan (south and central), Arunachal Pradesh (west), see Robson & Long (1983): fig. 3. Map 12.

BHUTAN. Central: Descent to Dimree Nuddee, 1920 m, 1862–63], *Griffith* 833 (K); Bhutan, [1862–63], *Griffith* 1820 (BM, K); Kuru Chu Valley, 1500 m, 28.viii.1915, *Cooper* 4700 (BM); Rungzhung, Gamri Chu, 1050 m, 18.iii.1936, *Ludlow & Sherriff* 1198 (BM, E); Ghunkara, Trashigong Chu, 1200 m, 30.v.1947, *Ludlow, Sherriff & Hicks* 12576 (A, BM); below Mongar, 1700 m, 16.vi.1979, *Grierson & Long* 1990 (BM). South: Samchi district, Torsa valley, 900–1200 m, iv.1905, *G. L. Searight* 108 (CAL n.v.).

INDIA. Arunachal Pradesh: Kameng district, near Jamiri, 1200 m, iv. & x.1977, *Sahni & Naithani* Ser.II, 546 (DD, n.v.) *Bennet & Naithani* 3244 (DD n.v.).

H. griffithii is apparently restricted to two disjunct areas (south-western Bhutan and east-central Bhutan/western Arunachal Pradesh). In Bhutan it was not collected between 1862–63, when Griffith found it, and 1915. Both the Ludlow & Sherriff and Grierson & Long expeditions rediscovered it by retracing Griffith's route.

It is clearly intermediate between the more erect, broad-leaved forms of *H. oblongifolium* (of Nepal) and the more primitive species of sect. 5. *Androsaemum* (*H. grandifolium, H. hircinum*), which differ essentially in having a trimerous gynoecium.

16(27). **Hypericum monogynum** L.

Spl. pl. 2nd ed.: 1107 (1763); Miller, *Gard. dict.* [7th ed.: No. 11 (1759) nom. illegit.] 8th ed.: no. 11 (1768); Thunb., *Fl. Jap.*: 297 (1784); Curtis, *Bot. Mag.*: t. 334 (1796); Blume, *Bijdr. Fl. Ned. Ind.* **1**: 141 (1825); N. Robson in *Blumea* **20**: 251 (1973); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 419 cum fig. (1973); N. Robson in Nasir & Ali, *Fl. W. Pakistan* **32**: 3 (1973); in *Fl. malesiana* I, **8**: (1974). Type: Miller, *Figures plants*: 101, t. 151, f. 2 (1760) (BM!, typotype).

H. chinense L., *Syst. nat.* 10th ed. **2**: 1184 (1759), *Diss. exhib. C. N. Hellenius*: 6 (1776), *Amoen. Acad.* **8**: 323 (1785); Trew, *Pl. rar.*: t. 21, fig. II (1784); Lam., *Encycl. méth.* (Bot.) **4**: 144 (1797); Willd., *Sp. pl.* **3** (2): 1449 (1803); Choisy, *Prodr. monogr. fam. Hypéric.*: 40 (1820); in DC., *Prodr. syst. nat. regni veg.* **1**: 545 (1824); G. Don, *Gen. Syst.* **1**: 602 (1831); Bunge in *Mem. Acad. Sci. St. Petersb.* **2**: 84 (1833); Choisy in Zollinger, *Syst. Verz. Ind. Archipel.* **2**: 150 (1857), *Pl. javan.*: 5 (1858); K. Koch, *Hort. dendrol.* **1**: 494 (1869); Hance in *J. Bot., Lond.* **17**: 81 (1879); Ito & Kaku, *Koisikawa-Syokubutu-Somoku-Zusetu* **2**: 17, t. 17 (1884); Hemsley in *J. Linn. Soc.* **23**: 72 (1886); Anon in *Gdnrs' Chron.* III, **1**: 705, f. 135 (1887); Koehne, *Deutsch. Dendrol*: 415 (1893); Diels in *Bot. Jahrb.* **29**: 475 (1900); R. Keller in *Bot. Jahrb.* **32**: 548 (1904); Matsumura & Hayata, *Enum. pl. Formosa*: 60 (1906); Léveillé in *Bull. Soc. bot. Fr.* **53**: 499 (1906), **54**: 590 (1908); Schneider, *Ill. Handb. Laubholzk.* **2**: 337, f. 224 (1909); Hayata, *Icon. pl. formos.*: 78 (1911); Matsumura, *Ind. pl. Jap.* **2**: 365 (1912); Rehder in Sargent, *Pl. Wils.* 2nd ed. **2**: 404 (1915); Makino & Nemoto, *Fl. Jap*: 540 (1925); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* **21**: 176 (1925); Chen, *Ill. man. chin. trees & shrubs*: 841, t. 735 (1937); Rehder, *Man. cult. trees & shrubs* 2nd ed.: 639 (1940); Backer, *Fl. Java* **1**: 382 (1963); N. Robson in *J. Roy. Hort. Soc.* **95**: 489 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 150 (1971); Knight in *J. Roy. Hort. Soc.* **96**: 38 (1971), non Osbeck (1757) nec. Retz. (1789). Type as for *H. monogynum* L.

H. aureum Lour., *Fl. cochinch.*: 472 (1790). Type: China, 'Habitat incultum prope Cantonem Sinarum', *Loureiro* (no specimen traced).

Norysca chinensis (L.) Spach, *Hist. nat. vég.* Phan. **5**: 427 (1836), in *Annls Sci. Nat.* (Bot.) II, **5**: 364 (1836); J. O. Voigt, *Hort. suburb. Calcutta*: 90 (1845); K. Koch, *Hort. dendrol.*: 65 (1853); Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856); Miquel, *Fl. Ind. bat.* **1** (2): 514 (1859); Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 103, f. 42 (1951).

H. chinense var. β sensu Hooker & Arnott, *Bot. Beechey's voy.*: 172 (1840).

H. salicifolium Sieb. & Zucc. in *Abh. K. Akad. Wiss. Munch.* **4** (2): 162 (1843); R.

Keller in *Bot. Jahrb.* **33**: 548 (1904); H. Léveillé in *Bull. Soc. bot. Fr.* **53**: 499 (1906), R. Keller in Engler & Prantl, *Nat. Pflanzenfam.*, 2nd ed. **21**: 176 (1925); Y. Kimura in *Bot. Mag., Tokyo* **54**: 88 (1940). Type: Japan, 'Crescit in Miaco, Osakka, alibi ob pulchritudinem florum', *Thunberg* (UPS).

Norysca salicifolia (Sieb. & Zucc.) K. Koch, *Hort. dendrol.*: 65 (1853); Blume, *Mus. bot. Lugd. Bat.* **2**: 23 (1856).

H. chinense var. *salicifolium* (Sieb. & Zucc.) Choisy in Zoll., *Syst. Verz. Ind. Archipel.* **1**: 150 (1854) ('*salicifolia*').

Norysca aurea (Lour.) Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856).

Norysca punctata Blume, *Mus. bot. Lugd. Bat.* **2**: 23 (1856). Type: '*Hypericum chinense* (haud Linn.) Chois. in De Cand. *Prodr.* I: 545 (excl. Syn) Spr. *Syst. Veg.* III 341. 5'. (Blume was misled by Choisy's description of the leaves and calyx as black-dotted.)

H. monogynum var. *salicifolium* (Sieb. & Zucc.) [Maxim. in *Bull. Acad. Petersb.* **27**: 428 (1881), in synon.] André in *Revue hort.* **61**: 464 (1889), in adnot..

H. chinense subsp. *salicifolium* (Sieb. & Zucc.) Kuntze, *Rev. gen. pl.* **1**: 60 (1891).

H. chinense subsp. *latifolium* Kuntze, *Rev. gen. pl.* **1**: 60 (1891). Type: Taiwan, 'Formosa' [*Oldham* 29 ?] (NY, holotype; BM!, K!).

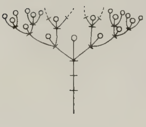
H. chinense subsp. *obtusifolium* Kuntze, *Rev. gen. pl.* **1**: 60 (1891). Type: India, 'Calcutta' [probably Hort. Bot. Calcutta, *Wallich* 4819 C (K!, holotype; BM!)].

H. prattii sensu Rehder in Sargent, *Pl. Wils.* **2**: 404 (1915) pro parte quoad *Wilson* 1604, 2420.

Komana salicifolia (Sieb. & Zucc.) Y. Kimura ex Honda, *Nomina pl. jap.*: 222 (1939); Hisauchi, *Kika-syokubutsu*: 180 cum fig. (1950), comb. invalid.

Norysca chinensis var. *salicifolia* (Sieb. & Zucc.) Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 107 (1951).

Icones: Curtis, *Bot. Mag.*: t. 334 (1796); Y. Kimura in Nakai & Honda, *Nov. fl. jap.* **10**: 105, f. 42 (1951); Fig. 15.

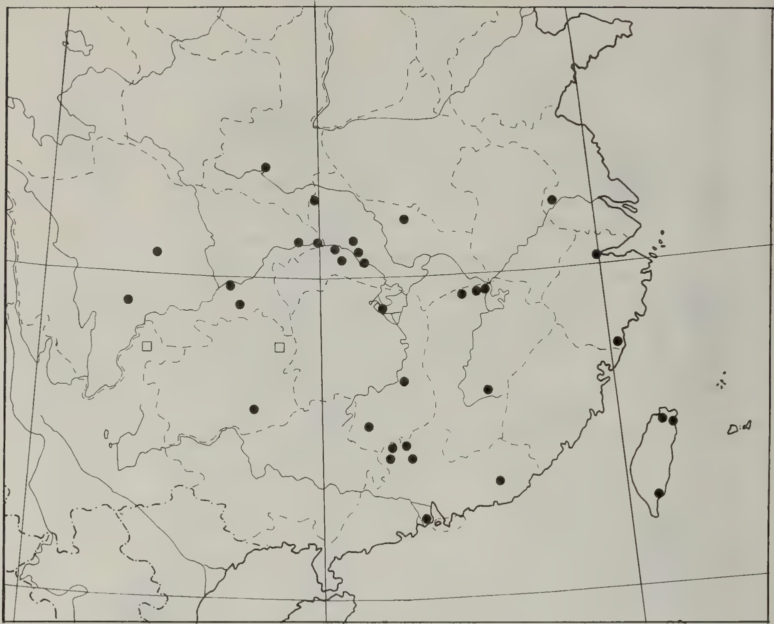


Shrub 0·5–1·3 m tall, bushy or usually with branches lax, spreading. *Stems* red, 2(4)-lined and ancipitous when young, soon terete; internodes 10–50 mm long, shorter than leaves; bark orange-brown. *Leaves* sessile or with petiole up to 1·5 mm long; lamina 20–112 × 10–41 mm, oblanceolate or elliptic to oblong or more rarely lanceolate to ovate-triangular or ovate, acute to rounded, often minutely apiculate, margin plane, base cuneate to rounded or in upper ones sometimes truncate to cordate, paler beneath, not glaucous, chartaceous; venation: 4–6 pairs main laterals, branched, not always distinct from the midrib branches, with tertiary reticulum dense, conspicuous; laminar glands very small, punctiform; ventral glands absent. *Inflorescence* 1–15(–30)-flowered, from apical node, loosely subcorymbiform, sometimes also from uppermost 1–3 nodes, rarely with 1–2 pairs of subsidiary branches; pedicels 8–28(50) mm long bracts small, linear-lanceolate, caducous. *Flowers* 30–65 mm in diam., stellate; buds ovoid, subacute to obtuse. *Sepals* 4·5–13 × 1·5–6 mm, imbricate, equal or unequal, ± spreading in bud and fruit, broadly or narrowly elliptic or oblong to lanceolate or oblanceolate, acute to rounded, margin entire; midrib distinct, other veins not prominent; laminar glands ± numerous, basally linear to striiform, punctiform towards apex. *Petals* golden yellow to lemon-yellow, not tinged red, spreading, 20–34 × 12–20 mm, 2·5–4·5 × sepals, triangular-obovate, with apiculus iateral, acute to rounded or obsolete; margin entire, eglandular. *Stamen fascicles* each with 25–35 stamens, longest 18–32 mm long, almost equalling petals; anthers yellow to pale orange. *Ovary* 2·5–5 × 2·5–3 mm, ovoid or ovoid-conic to subglobose; styles 12–20 mm, long, *c.* 3·5–5 × ovary, united almost to the apices then outcurved or very rarely free up to halfway; stigmas small. *Capsule* 6–10 × 4–7 mm, broadly ovoid or rarely ovoid-conic to subglobose. *Seeds* dark reddish-brown, *c.* 2 mm, long, cylindric, narrowly carinate, shallowly linear-reticulate to linear-foveolate. 2n = 42.

Cliffs, glens, gorges, limestone hills, roadsides, in dry localities; 0–1500 m.

SE. China (Shaanxi, Sichuan, Guizhou, Guangxi, Hubei, Jiangxi, Guangdong, Fujian, Zhejiang, Anhui, Jiangsu, Shandong; also recorded from Henan and

Fig. 15 *H. monogynum*: (a) habit; (b) leaf section; (c) flowering branch; (d) flower bud; (e) sepal; (f) petal; (g) stamen fascicle; (h) anthers; (i) ovary; (j) capsule (a, c × 1; b, d–g, i, j × 4; h × 20). (c) *Staunton & Nelson* s.n. (form(ii)); all others *Read* 1298 (form (i)).



Map 14 Sect. 3. *Ascyreia*: 16. *H. monogynum* ●, 17. *H. cohaerens* □.

Hunan). Probably introduced in the eastern lowlands. Native or possibly naturalised in Taiwan. Map 14.

CHINA. Shaanxi: Shiquan Xian, 880 m, 15.vi.1959, *Xing* 1463 (SZ). Sichuan: Nanchuan Xian, 1050–1350 m, 1.vi.1928, *Fang* 1241 (E, K); Fengjie, 1200 m, 23.vi.1958, *Zhou* 26377 (KUN). Guizhou: Dushan, 900 m, 24.vii.1959, *Li* 1356 (KUN). Guangxi: (locality uncertain), 3.viii.1956, *Liang* 100012 (IBSC). Hubei: Ichang, 300–500 m, v.1907, *Wilson* 2422 (BM, E, K); Zhuxi Xian, 18.vi.1959, *Li* 9529 (SZ) Jiangxi: Kiukiang, 1874, *Forbes* 836 (BM). Guangdong: Yeung Shan, S. of Linchow, vii–ix.1932, *Tsui* 487 (K); Ying Tak, 10.iv.1914, *Tutcher* in Hb. Hongkong. 10618 (IBSC, K). Fujian: Amoy Island, 20.v.1923, *Chung* 1636 (A, E, K). Zhejiang: S. of Ping Yung, 60–175 m, vi–vii.1924, *Ching* 1912 (E). Anhui: Li Shan, NW. of Chemen, 210 m, 5.viii.1925, *Ching* 3137 (E). Jiangsu: Ox Head Mountain near Nanking, vi.1922, *Merrill* 11392 (K). Shandong: Tai Ching Kung, Lao Shan, 13.viii.1930, *Chiao* 2909 (E, K).

TAIWAN. Taipeh: Grass Mountain, 20.v.1959, Liu & Kuo 123 (TAI). Ilan: Taihoku, Ins. Kizan, 3.vii.1932, *Masamune & Suzuki* NTU 076878 (TAI). Taitung: Taitung, *Sasaki* NTU 076877 (TAI).

CULTIVATED. Specimens seen from China, Hong Kong, Japan, India, Indonesia, Australia, Mauritius, Zimbabwe, South Africa, U.S.A., Mexico, Costa Rica, Cuba, Jamaica, Martinique, Scotland, England, Ireland, France, Germany, Estonia and (?) Portugal.

NATURALISED. Japan, N. and E. Taiwan.

H. monogynum is a very variable species in which the main clinal variation has been complicated by another set of variations in part of the range of the species.

(i) The form with elliptic to oblanceolate, acute, cuneate-based leaves, a very lax inflorescence and narrowly elliptic, acute sepals (Kuntze's subsp. *salicifolium*) is nearest to *H. gaitii* of India. It is a native of upland regions of central China (Shaanxi, Sichuan, western Hubei), whence it has apparently spread (at least partly by introduction) into the coastal lowlands from Fujian north to Shandong. From these lowland regions it was introduced into Japan at an early date and brought to Europe from there by Oldham in 1861. It is now cultivated widely in Europe, N. America and other temperate regions, where it is more or less hardy.

(ii) In eastern Hubei and Jiangxi, form (i) is gradually replaced by one with shorter, oblong leaves, obtuse to rounded at the apex and rounded at the base, a less lax inflorescence and narrowly oblong, obtuse sepals (Kuntze's subsp. *obtusifolium*), which attains its extreme form in coastal Guangdong. From this area it was introduced into England by Sir George Staunton and David Nelson, who accompanied Lord Macartney on his famous mission to China in 1753. It was grown in the Earl of Northumberland's garden at Stanwick and subsequently at Chelsea Physic Garden by Philip Miller, whose illustration is the type of both *H. monogynum* and *H. chinense* L. This lowland form was introduced to India (Calcutta Botanic Garden) and is now widely cultivated in the warmer regions of the world. According to Miller, it can survive outside in a very warm situation in England.

The form native or naturalised in Taiwan (Kuntze's subsp. *latifolium*) is somewhat intermediate between forms (i) and (ii) but has solitary flowers.

(iii) Throughout the range of form (i) there are plants with a similar lax inflorescence but with broader leaves and sepals (the latter sometimes being foliaceous). The leaves may vary from broadly elliptic, acute and cuneate at the base (e.g. *Fang* 12366 from Chengdu, Sichuan) to broadly oblong, rounded and cordate at the base (e.g. *Wilson* 1094 from Changyang, western Hubei). Plants of the latter extreme form were identified by Sargent (*Pl. Wilsonianae*) as *H. prattii* (q.v.). Specimens of this form have also been seen from Guizhou and Shandong, perhaps introduced.

(iv) In an extreme form of (iii), occurring in Sichuan, the leaves are short, elliptic to ovate or triangular-ovate, obtuse to rounded at the apex, broadly cuneate to rounded at the base (e.g. *Xiong & Li* 91225 and 91554 (SZ), both from Nanchuan Xian). The sepals, however, are long and narrow, as in *H. cohaerens*.

Although these forms differ widely in their extreme manifestations, and indeed appear to be related to different species and even sections (Fig. 4, p. 170), it does not seem possible to recognise them taxonomically owing to complete morphological and geographical intergradation.

Typical examples of the forms may be identified by the following key:

1. Leaves narrowly elliptic to oblanceolate, apex acute to subacute, base cuneate; inflorescence usually lax ('salicifolium') .... Form (i)
   Leaves broadly elliptic to oblong or ovate (or, if oblanceolate, then apex obtuse to rounded), apex obtuse to rounded or rarely acute, base cuneate to sub-rounded; inflorescence usually ± dense or flowers solitary 2

2. Leaves narrowly oblong to lanceolate, apex obtuse to rounded, base rounded or rarely cuneate ('obtusifolium') .... Form (ii)
   Leaves broadly oblong or broadly elliptic to ovate (or if lanceolate, then acute), apex acute to rounded, base rounded to cordate 3

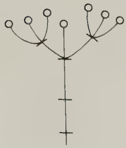
3. Leaves broadly oblong to broadly elliptic or lanceolate; sepals broadly elliptic to broadly oblong or foliaceous, apex obtuse to rounded ('latisepalum') .... Form (iii)
   Leaves broadly elliptic-oblong to triangular-ovate or ovate; sepals narrowly elliptic, apex acute ('ovatum')................................. Form (iv)

17(28). **Hypericum cohaerens** N. Robson, **sp. nov.**

H. monogyno L. affinis, sed foliis petiolo 1·5–2 mm longo, floribus in alabastro subacuminatis, sepalis anguste lanceolatis vel linearibus, petalis quam sepalis duplo longioribus apiculo acuto, stylis libris sed proximaliter cohaerentibus,

differt. Type: China, Guizhou, Fan-Tsing Shan, 2000 m, 9.vii.1931, *S. S. Sin* F.51002 (IBSC!, holotype).

Icon: —.



Shrub, with branches spreading ? *Stems* red, 4-lined and ancipitous when young, soon terete; internodes 15–23 mm long, shorter than leaves; bark reddish-brown. *Leaves* petiolate, with petiole 1·5–2 mm long; lamina 25–50 × 12–23 mm, oblong to elliptic, acute to rounded, margin plane, base cuneate to subangustate, paler beneath, not glaucous ?, chartaceous; venation: 2–3 pairs main laterals, all or the upper sometimes uniting with midrib branches to form ± arched inframarginal vein (i.e. brochidodromous), with tertiary reticulum very dense, not very conspicuous; laminar glands very small, punctiform; ventral glands absent. *Inflorescence* 1–7-flowered, from apical node, loosely subcorymbiform; pedicels 8–11 mm long; bracts linear, caducous. *Flowers* 35–50 mm in diam., stellate; buds ovoid, subacuminate. *Sepals* 9–12 × 1·5–3 mm, slightly imbricate or open, equal, spreading in bud and young fruit, narrowly lanceolate to linear, acute, margin entire; midrib distinct, one other pair of veins sometimes visible beneath; laminar glands linear. *Petals* golden yellow ?, not tinged red, spreading, 16–25 × 8–13 mm, *c.* 2 × sepals, oblanceolate, with apiculus subterminal, acute, margin entire, eglandular ? *Stamen fascicles* each with *c.* 30 stamens, longest 16–20 mm, long (or probably longer), *c.* 0·8–0·95 × petals; anthers yellow. *Ovary* 4–5 × 3–4 mm, ovoid to subglobose; styles 10–12 mm long, *c.* 2·2–2·5 × ovary, at first up to half coherent but becoming free, straight; stigmas small. *Capsule* and *seeds* unknown. 2n = ?

No habitat cited; 1450–2000 m.

China (Guizhou, Yunnan). Map 14.

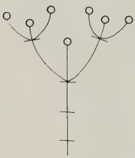
CHINA. Yunnan: Daguan, 1450 m, 16.v.1973, *Sun* 0620 (KUN) (see also type).

Apart from the free or almost free styles (which in this species are certainly a secondary development), *H. cohaerens* is morphologically more advanced than *H. monogynum*, e.g. in (i) the tendency to form brochidodromous (looped) leaf-venation, (ii) the longer petioles, (iii) the narrower sepals and (iv) the acute petal apiculus. In altitude (1450–2000 m) it exceeds that of nearly all *H. monogynum* records (0–1500 m). Its leaf shape and venation approach those of *H. formosanum* and its relatives in sect. 4. *Takasagoya*, but this is probably a parallel development. Its nearest relatives appear to be *H. monogynum* forms (iii) and (iv) (see Fig. 4).

18(29). **Hypericum prattii** Hemsley

in *J. Linn. Soc.* **29**: 303 (1892); Diels in *Bot. Jahrb.* **29**: 475 (1900); H. Léveillé in *Bull. Soc. bot. Fr.* **54**: 590 (1908); Rehder in Sargent, *Pl. Wilson.* **2**: 404 (1915) pro parte excl. *Wilson* 1640, 2420. Types: China, Sichuan, chiefly near Tachienlu, *Pratt* 381 (K!, lectotype–mihi; BM!, syntype); Min river, *Faber* 424 (K!, syntype); sine loc., *Henry* 8808 (K!, syntype).

Icon: —.



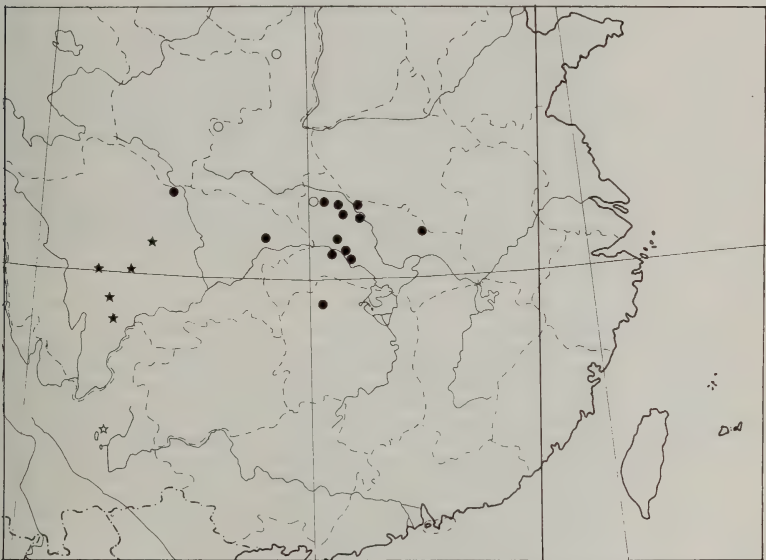
Shrub 0·75–1 m tall, with branches spreading. *Stems* red, 4-lined and ancipitous when young, soon terete; internodes 10–55 mm long, shorter than leaves; bark reddish-brown. *Leaves* sessile; lamina 40–110(145) × 20–51(70) mm, broadly ovate to elliptic-ovate, acute to shortly acuminate, margin plane, base cordate-amplexicaul or (uppermost) rounded, rather paler beneath, not glaucous, chartaceous; venation: 4–5 pairs main laterals, branched, the midrib pinnately branched, with tertiary reticulum dense, conspicuous especially beneath; laminar glands punctiform, very small; ventral glands absent. *Inflorescence* 3–10(–24)-flowered, from apical node, loosely subcorymbiform; pedicels 3–10(25) mm long (–60 mm in fruit); bracts small, linear, caducous. *Flowers* 35–55 mm in diam., stellate; buds ovoid, obtuse to rounded. *Sepals* 9–17(–19) × 3–9(–11) mm, free, imbricate, subequal to unequal, erect in bud, ? in fruit, lanceolate to broadly ovate-cordate (foliaceous), rounded, with margin entire; midrib distinct, other veins not prominent; laminar glands *c.* 9–numerous, basally linear, distally punctiform, *Petals* golden yellow, not tinged

red, spreading, 20–26 × 9–18 mm, 1·5–2·3 × sepals, obovate to oblanceolate, with apiculus lateral, rounded or obsolete; margin entire, eglandular. *Stamen fascicles* each with 30–40 stamens, longest 18–24 mm long, almost equalling petals; anthers yellow. *Ovary* 4–6 × 2·5–4·5 mm, ovoid; styles 11–19 mm long, *c.* 3–3·5 × ovary, united almost to the apices then spreading; stigmas small. *Capsule* and *seeds* not seen.

'Glens' (*Wilson* 2421a); 300–*c.* 3000? m.

China (north-eastern Yunnan ?, Sichuan, western Hubei). Map 15.

CHINA. Yunnan: environs de Yunnan-fou [Kunming], v.1908, *Alleizette* (L) (see note below). Sichuan: [no precise locality], pre-ii. 1890, *Henry* 8808 (K); Yangtze-kiang, Min R., pre-xii. 1887, *Faber* 424 (K); chiefly near Tachienlu [Kangding] 2700–4050 m, *Pratt* 381 (BM, K); Emei Shan [Mt. Omei], 1000 m, 22.vii.1957, *Yang* 55980 (KUN, SZ). Hubei: Ichang, 300 m, v.1907, *Wilson* 2421a (BM, E, K).



Map 15 Sect. 3. *Ascyreia*: 18. *H. prattii* ★, ☆ (doubtful), 19a. *H. longistylum* subsp. *longistylum* ●, 19b. *H. longistylum* subsp. *giraldii* ○.

H. prattii is closely related to *H. monogynum*, but differs in its ovate, often acuminate, leaves, nearly always with cordate-amplexicaul base. Using these distinguishing characters, *Wilson* 1604 and 2420, cited as *H. prattii* by Rehder in Sargent, *Pl. Wils.* **2**: 404 (1915), must be transferred to *H. monogynum*. These specimens are somewhat intermediate; but from a study of the available material, it seems better to treat *H. monogynum* and *H. prattii* as distinct species rather than to give the latter the varietal status suggested by Rehder.

The Wilson specimen (from W. Hubei) has larger flowers and broader sepals than have the original collections from Sichuan, and was collected at a much lower altitude. The absence of other records from near Kunming (let alone elsewhere in Yunnan) throws doubt on the provenance of the Alleizette specimen.

19(30). **Hypericum longistylum** Oliver

in Hook., *Icon. pl.* **16**: t. 1534 (1886); Diels in *Bot. Jahrb.* **29**: 476 (1900); H. Léveillé in *Bull. Soc. bot. Fr.* **54**: 591 (1908); Pampini in *Nuovo G. bot. ital.* II, **17**: 670 (1910); Rehder in Sargent, *Pl. Wilson.* **2**: 404 (1915); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.*, 2nd ed. **21**: 176 (1925) Types: China, Hubei, Ichang, *Henry* 582 (K!, lectotype–mihi), *Henry* 217 (K!, syntype), *Henry* 994 (K!, syntype).

Shrub c. 1 m tall, erect, with long branches divaricate and short ones pinnate. *Stems* red, 2–4-lined and ancipitous when young, eventually terete; internodes 10–30 mm long, shorter than to exceeding leaves; bark pale grey. *Leaves* subsessile or with petiole up to 1 mm long; lamina 10–31 × 6–16 mm, narrowly oblong to elliptic or subcircular, rounded to subapiculate, margin plane, base cuneate to shortly angustate, ± densely glaucous beneath, chartaceous; venation: *c.* 3 pairs main laterals (faint), the midrib branches not or scarcely visible, without or rarely with very faint tertiary reticulum; laminar glands small to very small dots; ventral glands absent. *Inflorescence* 1-flowered, terminal and on short lateral branches; pedicels 8–12 mm long; bracts foliar, persistent. *Flowers* 25–45(–50) mm in diam., stellate; buds narrowly ellipsoid, acute. *Sepals* 3–6(–10) × 0·5–2(–3) mm, free or united at the base, imbricate to open, equal or subequal, spreading or recurved in bud and fruit, linear or rarely elliptic, acute, with margin entire; midrib ± conspicuous, other veins not prominent; laminar glands *c.* 4, basally linear, punctiform toward apex. *Petals* golden yellow to orange, not tinged red, spreading, (11–)15–22(–24) × 4–8(–10) mm, 2·5–3·5 × sepals, oblanceolate, without or almost without apiculus, margin entire, eglandular. *Stamen fascicles* each with *c.* 15–25 stamens, longest 15–25 mm long; anthers yellow. *Ovary* 3–4 × 2–3 mm, ellipsoid to globose, sometimes substipitate; styles 10–18 mm long, *c.* 3·5–6 × ovary, united almost to the apices then spreading; stigmas small. *Capsule* (4–)6–12 × 4–5 mm, ellipsoid to subglobose, sometimes substipitate. *Seeds* not seen. 2n = ?

On cliffs and dry banks; 200–2090 m.

China (Hubei, Shaanxi, Hunan). Also recorded from Gansu, Sichuan, Henan, and Anhui. Map 15.

H. longistylum is most similar morphologically to form (iv) of *H. monogynum* from Sichuan (Fig. 4). Pampanini, in *Nuovo G. bot. ital.* II, **17**: 670 (1910), described three varieties of this species: (i) var. *longistylum* with large flowers and ellipsoid ovary and fruit, (ii) var. *silvestrii* with small flowers and ellipsoid ovary and fruit, (iii) var. *giraldii* with large flowers and globose ovary and fruit. Vars (i) and (ii) both occur at lower altitudes (200–1200 m) in north and west Hubei, Sichuan and Hunan (and probably Ankui and Henan) and cannot be distinguished on flower size; whereas var. *giraldii* is found at higher altitudes (1950–2090 m) in central to north Hubei and in central and north Shaanxi and possibly Gansu. The difference in ovary shape between vars (i)–(ii) and (iii) seems to be constant, although some specimens of 'var. *silvestrii*' have rather broader ovaries than is usual in var. *longistylum*. It seems possible, then, to recognise two subspecies, rather than varieties, as follows:

19a(30a). **H. longistylum** subsp. **longistylum**

H. longistylum var. *silvestrii* Pampanini in *Nuovo G. bot. ital.* II, **17**: 670, f. 15b (1910). Types: China, Hubei, Sce-men, *Silvestri* 1490 (FI!, lectotype); presso Siang-yang, *Silvestri* 1486 pro parte (FI!); sine loco, *Silvestri* 1489 (FI); Sce-men, *Silvestri* 1490a (FI!); Kai-scian, *Silvestri* 1491 (FI!) (all syntypes).

Norysca longistyla (Oliver) Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 98 (1951).

Icon: Oliver in Hook., *Icon. pl.* **16**: t. 1534 (1886).

Sepals 3–6 mm long. *Ovary* and *capsule* ellipsoid, usually substipitate.

China (north and east Sichuan, north and west Hubei, north Hunan, recorded from Henan, Anhui); 200–1200 m. Map 15.

CHINA. Hubei: Hsing-shan Hsien, 600 m, 8.vi.1907, *Wilson* 2423 (BM, E, K);

Ichang, 300 m, iv.1907, *Wilson* 2424 (BM, K); U-tan-scian [Wu-tang shan], iii.1912, *Silvestri* 6197 (BM, FI); Wudang shan, near South Crag Temple, 800 m, 16.v.1983, *Lancaster* 1184 (BM); Nan-T'o [Nanto] and mountains to northward, pre ii.1887, *Henry* 1999 (K); Jun Xian 11.viii.1959, *Xing* 11098 (SZ). Hunan: Dayong, 470 m, 23.v.1978, *Sheng* 1320 (IBSC).

19b(30b). **H. longistylum** subsp. **giraldii** (R. Keller) N. Robson, **stat. nov.**

H. giraldii R. Keller in *Bot. Jahrb.* **33**: 548 (1904); Pavolini in *Nuova G. bot. ital.* II, **15**: 406 (1908); H. Léveillé in *Bull. Soc. bot. Fr.* **54**: 590 (1908). Type: China, Shaanxi, 'in monte Lun-san-huo', *Giraldi* 539 (FI!, holotype).

H. longistylum var. *giraldii* (R. Keller) Pampanini in *Nuovo G. bot. ital.* II, **17**: 670, f. 15c (1910).

Icon: Pampanini, in *Nuovo G. bot. ital.* II, **17**: 670, f. 15c (1910).

Sepals 5–7 mm long. *Ovary* and *capsule* globose, sessile.

China (north-west Hubei, central and north Shaanxi, recorded from Gansu as *H. longistylum*); 1950–2090 m. Map 15.

CHINA. Hubei: Zan-lan-scien [Zan-lan Shan], iv.1912, *Silvestri* 6196 (FI); Scian-Kiu, iii.1912, *Silvestri* 6200 (FI); Ou-tan-scian [Wu-tang Shan], 2090 m, vii.1907, *Silvestri* 1488 (FI); Monti Triori, 1950 m, 3.vii.1907, *Silvestri* 1487 (FI). Shaanxi. Monti del Lun-san-suo, v.1895, *Pio Nesi* in *Giraldi* 539 (FI); N. Central China, pre-1900, *Fr. Hugh* (BM) (type collection ?).

20(31). **Hypericum subsessile** N. Robson, **sp. nov.**

H. mysurensi Wight & Arnott affinis, sed foliis subsessilibus venatione densiore reticulati, floribus vade cyathiformibus, sepalis latioribus, stylis brevioribus, differt. Type: China, Yunnan, Tali Range, viii.1929, *Forrest* 28133 (BM!, holotype; E!, isotype).

Icon: —.

Shrub c. 1 m tall. *Stems* red, 4-angled and ancipitous when young, eventually terete; internodes 10–30 mm long, shorter than leaves; bark grey-brown. *Leaves* subsessile, with very short flat petiole; lamina 35–65 × 7–20 mm, narrowly elliptic, acute, margin plane, base cuneate, paler to glaucous beneath, subcoriaceous; venation: 3–4 pairs main laterals, branched, the midrib pinnately branched, with tertiary reticulum rather lax, not very conspicuous; laminar glands small dots and short streaks; ventral glands sparse to dense. *Inflorescence* 1–8-flowered, from 1(2) node(s); pedicel 8–20 mm long; bracts small, lanceolate to foliar, deciduous. *Flowers* 35–45 mm in diam., shallowly cyathiform; buds ovoid, acute. *Sepals* 10–18 × 4–10 mm, free, imbricate, unequal (foliaceous), outcurved in bud, reflexed in fruit, ovate to elliptic, acute or acuminate, with margin entire; midrib clearly visible, veins not prominent; laminar glands *c.* 8, basally linear, punctiform toward apex. *Petals* bright yellow, tinged red dorsally, slightly incurved, 17–20 × 9–11 mm, *c.* 2 × sepals, oblanceolate-obovate, with apiculus subterminal, acute; margin entire, eglandular. *Stamen fascicles* each with 40–60 stamens, longest 12–15 mm, long, *c.* 0·7 × petals; anthers bright yellow. *Ovary* 6–8 × 5–6 mm, ovoid-conic; styles 5–6 mm long, 0·8–0·9 × ovary, free, outcurved near apex; stigmas narrowly capitate. *Capsule* (16–)18–21 × (7–)10–12 mm, narrowly ovoid-conic. *Seeds* dark reddish-brown, 1·1–1·5 mm long, cylindric, with terminal and unilateral wing, shallowly linear-foveolate. 2n = ? See also p. 325.

Thickets; 2400–2550 m.

China (Yunnan, Sichuan). Map 17.

CHINA. Yunnan: Tali Range, viii.1929, *Forrest* 28133 (BM, E). Sichuan: Hanyuan Hsien, 2400–2550 m, 11.x.1928, *Fang* 3744 (E, K).

As well as having affinities directly with *H. mysurense, H. subsessile* is related to both *H. siamense* and *H. acmosepalum* and is morphologically intermediate between them. It differs from the former by its longer, narrower leaves and larger foliaceous

sepals, and from the latter by its subsessile leaves with lax reticulate venation, longer (often foliaceous) sepals, broader petals and shorter stamens and styles.

H. subsessile is apparently very local in occurrence, having been found in only two widely separated localities. The Yunnan plant has solitary flowers, whereas the one from Sichuan has 1–8-flowered branches. Otherwise the collections are similar and appear to be conspecific.

21(32). **Hypericum siamense** N. Robson, **sp. nov.**

H. leschenaultio Choisy affinis, sed foliis ellipticis vel oblongis haud lanceolatis vel ovatis, apice acutis vel obtuse apiculatis, vena intramarginali atque nervatura secundaria pinnate valde manifestis instructis, sepalis ovato-triangularibus, differt. Type: Thailand, Doi Chiengdao, *c.* 1900 m, 6.xi.1922, *Kerr* s.n. (BM!, holotype; ABD!, isotype).

H. sp. sensu Smitinand in *Nat. Hist. Bull. Siam Soc.* **21**: 100 (1966).
H. cf. *patulum* sensu Smitinand, tom. cit.: 102 (1966).

Icon: Fig. 16.

Shrub 0·3–3 m tall, bushy, with short ascending lateral branches. *Stems* red, 4-lined and ancipitous when young, eventually terete; internodes 5–20 mm, long, shorter than leaves, bark grey-brown. *Leaves* subsessile or petiolate, with petiole 1–2 mm long, broad; lamina 25–36 × 7–18 mm, oblong (lower) to elliptic (upper), acute to apiculate-obtuse, margin plane, base ± broadly cuneate to rounded or subauriculate, paler beneath, not glaucous, chartaceous; venation: 1–3 pairs main laterals, the outer joining upper laterals to become intramarginal vein, all dark and easily visible (when dry), with lax or scarcely visible tertiary reticulum; laminar glands very short streaks and dots; ventral glands sparse to dense. *Inflorescence* 1–5-flowered, from 1–2 nodes, subcorymbiform, pedicels 10 mm, long; bracts narrowly elliptic, persistent. *Flowers* 40–50 mm in diam., shallowly cyathiform ?, buds ovoid, acute to subacute. *Sepals* 8–12 × 3–6 mm, free, imbricate, unequal, spreading to reflexed in bud and fruit, triangular-ovate, acute, margin entire, midrib visible below, veins slightly prominent; laminar glands numerous, linear, interrupted towards apex. *Petals* deep ? golden yellow, tinged red dorsally, slightly incurved, 20–24 × 12–17 mm, 2–2·5 × sepals, narrowly to broadly obovate, with apiculus obtuse to rounded, lateral, margin entire, eglandular. *Stamen fascicles*, each with *c.* 45–50 stamens, longest 10–11 mm. long, *c.* 0.35–0.5 × petals; anthers golden yellow to orange. *Ovary* 5–7 × 3–3·5 mm, ovoid to narrowly ovoid-conic; styles 2·5–6 mm long, 0·4–0·8(–1) × ovary, free, outcurved near apex; stigmas small. *Capsule c.* 15 – 7 mm, ovoid-conic. *Seeds* pale orange-brown (? immature), *c.* 1·0 mm long, cylindric, narrowly carinate, shallowly linear-reticulate to linear-foveolate. 2n = ?

Shrub layer of open evergreen hill forest on exposed ridges, on crystalline limestone; 1900–2200 m.

Thailand (Northern: Doi Chiengdao). Map 16.

THAILAND. Northern: all from Chiengmai, Doi Chiengdao: *c.* 1900 m, 6.xi.1922, *Kerr* s.n. (ABD, BM); 2100–2200 m, 3.xii.1961, *Smitinand & Anderson* 7303 (K); 2000–2200 m, 10.xi.1962, *Smitinand, Poore & Robbins* 7789 (AAU, BKF, E, L); 1900–2100 m, 17.viii.1963, *Smitinand & Sleumer* 1055 (L, SING); *c.* 2000 m, 7.xii.1965, *Hennipman* 3277 (L); 1900–2175 m, 14.ix.1967, *Shimizu, Koyama & Nalampoon* T. 10109 (BKF); 1900–2100 m, 26.ix.1971, *Murata et al.* T. 15262 (BKF, K); 1900–2100 m, 27.ix.1971, *Murata et al.* T. 15214 (AAU).

H. siamense, like *H. subsessile* and *H. apiculatum*, is a relict species. It shows some resemblances to *H. subsessile*, but its leaf shape and venation, together with its triangular-ovate sepals, make it unmistakable.

It is clearly a near ancestor of *H. leschenaultii*, of which the nearest population is in Sumatra, differing from it *inter alia* by the oblong to elliptic leaves, with a clear intramarginal vein, markedly pinnate laterals and a shorter petiole, and usually by the shorter sepals.

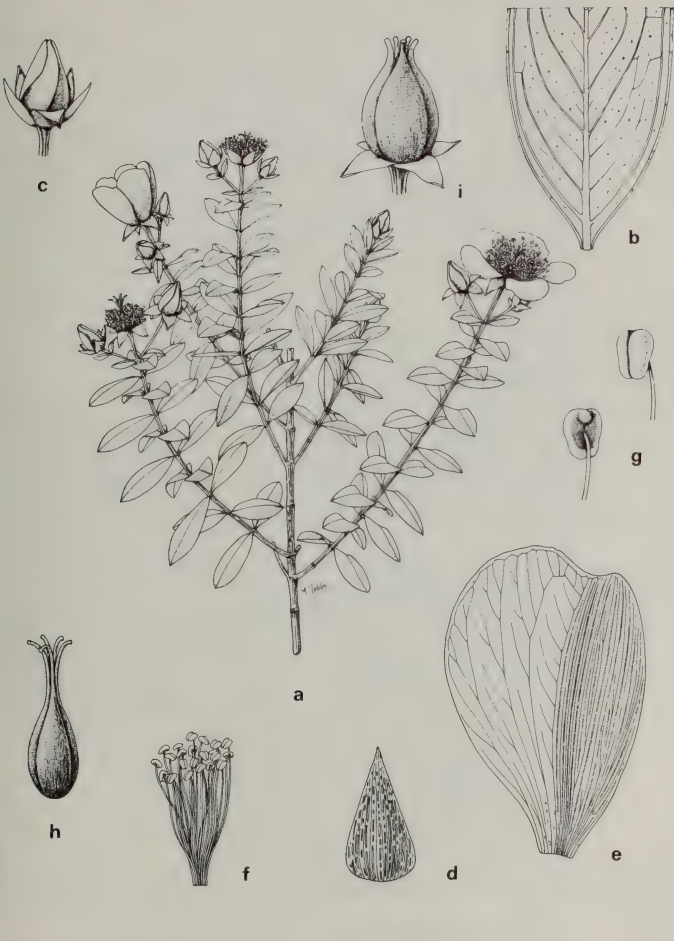
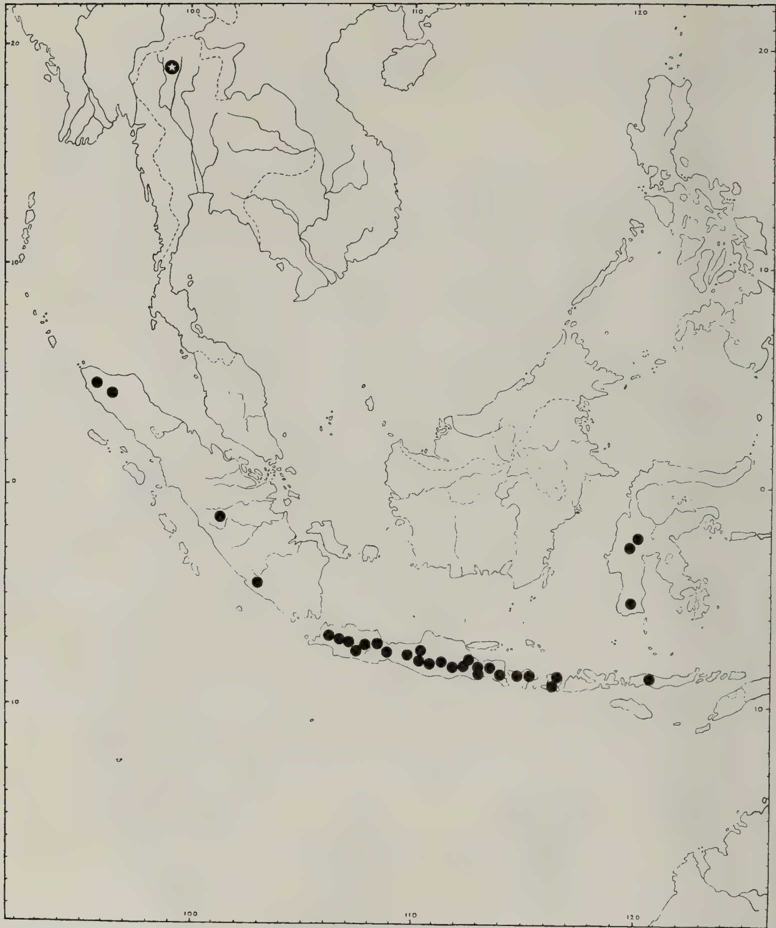


Fig. 16 *H. siamense*: (a) habit; (b) leaf section; (c) flower bud; (d) sepal; (e) petal; (f) stamen fascicle; (g) anthers; (h) ovary; (i) capsule (a × 1; c, i × 4; b, d–f, h × 6; g × 20). All *Murata et al.* T15214.



Map 16 Sect. 3. *Ascyreia*: 21. *H. siamense* ✪, 22. *H. leschenaultii* ●.

22(33). **Hypericum leschenaultii** Choisy

in DC., *Prodr. syst. regni nat. veg.* **1**: 545 (1824); Guillemin in Delessert, *Ic. sel. pl.* **3**: 17, t. 27 (1837); Choisy in Zollinger, *Syst. Verz. Fl. Ind. Archip.* **2**: 151 (1854); Stapf in *Curtis's bot. Mag.* **152**: t. 9160 (1925); Hochreutiner in *Candollea* **2**: 435 (1925); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925); Doct. v. Leeuwen in *Trop. Natuur.* **16**: 115, f. 3 (1927), in *Verk. K. Akad. Wet Amsterdam* Afd. Natuurk. (2de sect.) **31**: 181 (1933); Merrill in *Contr. Arn.*

Arbor. **8**: 107 (1934); v. Steenis in *Bull. Jard. bot. Buitenz*. III, **13**: 219 (1934); Bakker & Bakh. f., *Fl. Java* **1**: 382 (1963); Robson in *J. Roy. Hort. Soc*. **95**: 489 (1970); v. Steenis, *Mtn fl. Java*: t. 23 f. 6(1972); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 417 (1973); Robson in *Fl. malesiana* I, **8**: 17, ff. 12, 13 (1974). Type: Indonesia, Java, *Leschenault* (P).

H. javanicum Blume, *Bijdr. fl. Ned. Ind*. **1**: 141 (1825); Hasskarl, *Cat. pl. hort. bogor. alter*.: 213 (1844); Moritzi, *Syst. Verz. Zollinger*: 25 (1845–56); Choisy in Zollinger, *Syst Verz. Ind. Archipel*. **2**: 151 (1954). Type: Java, 'In altis montium Javae insulae'. [Mt. Gede] *Blume* 557 (L!, holotype; BM!).

H. coriaceum Blume, *Bijdr. fl. Ned. Ind*. **1**: 142 (1825). Type: Java, 'In cacumine montis Tjerimai Provinciae Cheribon', *Blume* (L!, lectotype; BM!).

H. triflorum Blume, *Bijdr. fl. Ned. Ind*. **1**: 142 (1825); Hasskarl, *Cat. Pl. Hort. Bogor. Alter*: 213 (1844); Moritzi, *Syst. Verz. Zollinger*: 25 (1845–46); B[urbidge] in *The Garden* **23**: 158 cum fig. (1883); R. Keller in Engler & Prantl, *Nat. Pflanzenfam*. **3** (6): 209, 210, f. 100 (1893), 2nd ed. **21**: 176, f. 73 (1925). Type: Java, 'In cacumine montis Gede', *Blume* (L!).

H. triflorum var. *angustatum* Blume, *Bijdr. fl. Ned. Ind*. **1**: 143 (1825). Type: Java, 'In vicinitate catarractarum montis Gede', *Blume* (L!).

H. nervosum Choisy in Zollinger, *Syst. Verz. Ind. Archipel*. **1**: 151, 152 (1854); Koorders in *Natuurk. Tijdschr*. **60**: 259 (1900); Ernst in Karsten & Schenk, *Veget. Bild*. **7** (2): t. 4–5 (1910), non *H. nervosum* D. Don (1825), nom. illegit. Type: Java, 'In montosis Waliran, supra 5000 ft.', *Zollinger* 1565 (n.v.).

Norysca leschenaultii (Choisy) Blume, *Mus. bot. Lugd. Bat*. **2**: 24 (1856); Miquel, *Fl. Ind. bat*. **1** (2): 515 (1859); Y. Kimura in Nakai & Honda, *Nova fl. jap*. **10**: 98 (1951).

Norysca javanica (Blume) Blume, *Mus. bot. Lugd. Bat*. **2**: 24 (1856); Miquel, *Fl. Ind. bat*. **1** (2): 514 (1859).

Norysca coriacea (Blume) Blume, *Mus. bot. Lugd. Bat*. **2**: 24 (1856); Miquel, *Fl. Ind. bat*. **1** (2): 515 (1859).

Norysca rorida Blume, *Mus. bot. Lugd. Bat*. **2**: 514 (1856); Miquel, *Fl. Ind. bat*. **1** (2): 514 (1859). Type: Java, *Blume* (L!).

Norysca nervosa (Choisy) Miquel, *Fl. Ind. bat*. **1** (2): 515 (1859).

H. hookerianum var. *leschenaultii* (Choisy) Dyer in Hook. f., *Fl. Brit. Ind*. **1**: 254 (1874) pro parte, quoad typum.; Besant in *Gdnrs' Chron*. **74**: 135, f. 49 (1923).

H. patulum [subsp.] (*a*) *leschenaultii* (Choisy) Kuntze, *Rev. gen. pl*. **1**: 60 (1891) ('*leschenaultianum*').

H. patulum subsp. *variabile* Kuntze, *Rev. gen. pl*. **1**: 60 (1891). Type: Java, Dieng, 1600–2300 m, 16.viii.1875, *Kuntze* (NY, photo!); Sumbing, 3100 m, 13.viii.1875, *Kuntze* (NY, photo!).

H. hookerianum sensu Buysmann in *Flora, Jena* **107**: 358 (1914), non Wight & Arnott (1834).

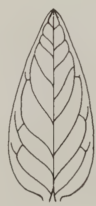
H. leschenaultii var. *typicum* Hochr. in *Candollea* **2**: 435 (1925) '*typica*'. Type as for *H. leschenaultii* Choisy.

H. leschenaultii var. *typicum* forma *elatius* Hochr. in *Candollea* **2**: 435 (1925) ('*elatior*'). Type: Java (central), Mt. Perahoe, *c*. 2550 m, 5.xi.1904, *Hochreutiner* 2391 bis (G).

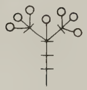
H. leschenaultii var. *coriaceum* (Blume) Hochr. in *Candollea* **2**: 435 (1925) ('*coriacea*').

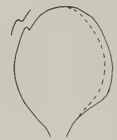
Norysca hookeriana var. *leschenaultii* (Choisy) Y. Kimura in Hara, *Fl. eastern Himalaya*: 210, 2nd ed: 81 (1971) pro parte, quoad typum.

Icon: Stapf in *Curtis's bot. Mag*.: t. 9160 (1925).



Shrub or small tree 0·5–2·5 m tall, dense and rounded or ± lax and elongate, with branches ± spreading. *Stems* red to orange, 4-lined and ancipitous when young, eventually terete; internodes 15–30 mm, shorter than leaves; bark grey-brown, smooth. *Leaves* petiolate, with petiole 1–2 mm long; lamina 25–80 × 10–37 mm, triangular-lanceolate to narrowly or rarely more broadly ovate, acute to apiculate-rounded, margin plane to recurved, base broadly cuneate to rounded, paler to glaucous beneath, chartaceous to subcoriaceous; venation: 3–4 pairs main laterals,





the midrib pinnately branched, with lax tertiary reticulum; laminar glands short streaks and dots; ventral glands absent or ± dense. *Inflorescence* 1–3(–10 or very rarely –18)-flowered, from 1–2 nodes, subcorymbiform; pedicels 5–12 mm long; bracts linear, persistent. *Flowers* (35–)40–70 mm in diam., shallowly cyathiform; buds ± broadly ovoid, acute to subacute. *Sepals* 7–20 × 2–8 mm (to 22 × 8 mm in fruit), free, imbricate, unequal, spreading to recurved in bud and fruit, narrowly oblong or ± narrowly elliptic or rarely ovate to oblanceolate, acute to subacute, with margin entire; midrib sometimes visible below, visible and sometimes incrassate above, veins not prominent; laminar glands numerous, linear, interrupted towards apex. *Petals* deep golden yellow, not tinged red, slightly incurved, (20–)25–45 × 14–30 mm, *c.* 2–3 × sepals, broadly obovate to subcircular, with apiculus acute to obtuse, lateral, margin entire, eglandular. *Stamen fascicles* each with *c.* 80 stamens, longest 9–12 mm long, *c.* 0·35 × petals; anthers golden yellow. *Ovary* 6–9 × 4–5 mm, ± narrowly ovoid-conic to narrowly ellipsoid-acuminate; styles 3·5–7 mm long, 0·5–0·9 × ovary, free, ± sharply outcurved near apex; stigmas small. *Capsule* 10–20 × 8–10(–13) mm, narrowly ovoid-conic to narrowly ellipsoid. *Seeds* dark orange-brown to reddish-brown, 0·8–1 mm long, cylindric, scarcely carinate, shallowly linear-reticulate to linear-foveolate. 2n = 20 ? (c.f. its presumed hybrid, 22 x. *H.* x. 'Rowallane').

Grassy slopes, thickets, and open woodland; 1500–3300 m.

Indonesia (Sumatra, Java, Lesser Sunda Islands, south-west Sulawesi). Map 16.

SUMATRA. Atjeh: Gaju & Alas Lands, summit of Mt. Goh Lembach, *c.* 2900 m, 21–22.iii.1937, *v. Steenis* 9112 (L); Westtop G. Losir, 2950–3500 m, 5–6.ii.1937, *v. Steenis* 8642 (BO). Barat: G. Kerintji [Kurintji], 3000 m, 4.v.1920, *Bünnemeijer* 9999 (GH, K, L). Selantan: G. Dempo, summit, 3000 m, viii.1923, *Brooks* 15917 (BO).

JAVA. Barat: Goenseng, summit of Mt. Pangrango, 3000 m, 29.iii.1950, *v. Oststroom* 13355 (CANB, FI, L, PNH). Tengah: Dieng plateau, S.W. helling G. Pangoran, *c.* 2150 m, 6.iv.1920, *v. Slooten* (L.). Timur: Besoeki, Jang Plateau West, Taman Hidoep, *c.* 1900 m, 13.vii.1938, *v. Steenis* 10786 (A, L, SING).

BALI. Bei Jirta auf Weg noch Gug Agoeng, *c.* 2100 m, 2.vi.1912, *Arens* 16 (BO, L).

LOMBOK. G. Rindjani, Segare Anak, 1925–2000 m, 11 v.1909, *Elbert* 1196 (L, PNH, SING).

FLORES. Sano Patjo-Gurung, 23.v.1970, *Verheijen* 3856 (L.).

SULAWESI. Selatan: G. Bonthain, N.W. side, 7.vi.1921, *Bünnemeijer* 11894 (K, L); B. Rantemario, 2800–3000 m, vi.1929, *Kjellberg* 3959 (BO).

CULTIVATED. Specimens seen from England (1882–3) and Ireland (1925).

H. leschenaultii is a variable species, the variation being to some extent clinal from west to east. Its presence to the east of the Wallace Line (in Lombok, Flores, and Sulawesi) is no doubt due to migration after the Malaysian and New Guinea regions made contact for the second time (see v. Steenis (1979), especially pp. 115–119 and the distribution map of *H. leschenaultii*, fig. 11).

In the British Isles, *H. leschenaultii* is hardy in southern England and in Ireland; but several hardier species (e.g. *H. addingtonii*) have been grown under that name.

The Sumatran form is the most primitive and approaches *H. siamense* in having, for example, more prominent and more numerous main lateral leaf veins than usual (4 pairs instead of 3), larger flowers and broader sepals. For differences between *H. leschenaultii* and *H. siamense* see p. 240.

22x(33x). **Hypericum** x 'Rowallane' (Armytage Moore)

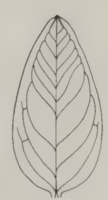
(22. *H. leschenaultii* x 33a. *H. hookerianum* 'Charles Rogers')

in *J. Roy. Hort. Soc.* **68**: 380, xlvii (1943), 'Rowallane Hybrid'; Comber in *Gdnrs' Chron.* **120**: 232, f. 106 (1946); J. B. Paton in *J. Roy. Hort. Soc.* **81**: 477 (1956); *H.* 'Rowallane Hybrid' G. Thomas in *Gdnrs' Chron.* III, **147**: 254 (1960); N. Robson in *J. Roy. Hort. Soc.* **95**: 484, 490 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 152 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 415, t. 51 (1973).

Standard specimen: Scotland, Wigtown, Logan, 22.ix.1977, *R.B.G. Edinb.* C. 11687 (BM!).

H. hookerianum 'Rowallane' F. Schneider in *Meded. Inst. Vered. Tuinbouwgew. Wageningen* **252**: 21 (1966); in *Dendroflora* **2**: 21 (1966).

Icon: Thomas in *Gdnrs' Chron.* III, **157**: 255 (1960).



Shrub up to 3 m tall, with branches erect, gradually outcurving. *Stems* orange, 4-lined and ancipitous when young, becoming quadrangular, eventually terete; internodes 10–70 mm long, shorter that to exceeding leaves; bark grey-brown. *Leaves* petiolate, with petiole 1–2 mm long; lamina 27–67 × 10–33 mm, ovate to oblong-ovate or oblong-lanceolate, apiculate-obtuse, base cuneate to truncate or subcordate, paler or ± glaucous beneath, chartaceous to subcoriaceous; venation: 3–4 pairs main laterals, the midrib pinnately branched, with tertiary reticulum lax and obscure or apparently absent; laminar glands short streaks and dots; ventral glands absent. *Inflorescence* 1–3-flowered, from apical node, subcorymbiform; pedicels 8–10(–15) mm long, bracts lanceolate or elliptic to oblanceolate, persistent. *Flowers* 50–75 mm in diam., shallowly cyathiform; buds ovoid, acute to obtuse. *Sepals* 10–14 × 4–7 mm, free, imbricate, unequal, spreading in bud and fruit, oblanceolate to obovate-spathulate, apiculate or rounded, with margin entire or apically eroded-denticulate; midrib visible or obscure, veins becoming slightly prominent; laminar glands linear, numerous. *Petals* deep golden yellow, not red-tinged, slightly incurved, 30–40 × 25–32 mm, *c.* 3 × sepals, obovate to subcircular, with apiculus subterminal, ± rounded; margin entire, eglandular. *Stamen fascicles* each with 70–90 stamens, longest 8–10 mm, long, 0·25–0·35 × petals; anthers golden yellow. *Ovary* 8–11 × 4–6 mm, ovoid to ovoid-ellipsoid; styles 6–7·5 mm long, *c.* 0·7 × ovary, free, diverging, outcurved towards apex; stigmas narrowly capitate. *Capsule c.* 13 × 10 mm, ovoid. *Seeds* rarely set, hybrid apparently usually sterile.* 2n = 20.

Known only in cultivation.

Cultivated specimens seen from England, Wales, Scotland, Ireland, and the U.S.A. (California).

H. x 'Rowallane' arose spontaneously in 1932 in the garden of Rowallane, Saintfield, Co. Down, N. Ireland, owned by T. Armytage-Moore. Cuttings were obtained by L. Slinger and propagated at Slieve Donard Nursery, Newcastle, Co. Down. It was first offered for sale by that nursery a few years later, and was given an Award of Merit by the Royal Horticultural Society in 1943.

The parentage of the hybrid is assumed, on grounds of both morphology and the proximity of suitable parental plants, to be *H. leschenaultii* x *"rogersii"* i.e. *H. hookerianum* 'Charles Rogers'.

23(34). **Hypericum acmosepalum** N. Robson

in *J. Roy. Hort. Soc.* **95**: 494, f. 238 (1970); [Lancaster], *Hilliers' Man. trees & shrubs*: 150 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 405 (1973). Type: China, Yunnan, on the Lichiang plain, 2460 m, v.1921, *Forrest* 19448 (K!, holotype; E!, isotype).

H. oblongifolium sensu hort. pro parte, non Choisy (1821).
H. patulum var. *oblongifolium* sensu hort. pro parte, non sensu Koehne (1893) nec *H. oblongifolium* Choisy (1821).
H. kouytchense sensu hort. pro parte, non H. Léveillé (1904).
H. patulum var. *henryi* sensu hort. pro parte, non Veitch ex Bean (1905).
H. henryi sensu hort. pro parte, non H. Léveillé & Vaniot (1908).

Icon: N. Robson in *J. Roy. Hort. Soc.* **95**: f. 238 (1970).

Shrub 0·6–2 m tall, with branches erect to ascending. *Stems* orange, 4-angled and ancipitous in first year (or longer), then terete; internodes 10–50 mm long, shorter

* A few apparently ripe seeds were observed in old capsules at Nymans, West Sussex, England (8.viii.1982).



than to exceeding leaves; bark grey-brown. *Leaves* broadly petiolate, with petiole 0·5–1(1·5) mm, long; lamina 18–42(–60) × 6–15(–20) mm, oblong or elliptic-oblong to narrowly elliptic (sometimes lanceolate towards apex of shoot and oblanceolate towards base), obtuse (rarely subacute) or apiculate to rounded, margin plane, ± recurved, base cuneate, markedly paler to glaucous beneath, chartaceous to sub-coriaceous; venation: 1–2 pairs main laterals (the upper forming distinct, often ± straight intramarginal vein), with midrib rather obscurely branched distally, with rather dense but very obscure or invisible tertiary reticulum; laminar glands ± small dots and sometimes short streaks, ventral glands sparse to rather dense. *Inflorescence* 1–3(–6)-flowered, from apical node, subcorymbiform; pedicels 7–17 mm long; bracts foliar to lanceolate, persistent. *Flowers* 30–50 mm in diam., stellate; buds ovoid, acute to subapiculate. *Sepals* (5–)6–9(–11) × 3–4(–6) mm, free, imbricate, subequal, ± outcurved in bud and fruit, ovate to narrowly lanceolate, acute or acuminate, with margin subentire or minutely and ± irregularly denticulate (especially towards apex); midrib ± conspicuous, veins not prominent; laminar glands linear or interrupted, *c.* 8. *Petals* deep yellow, sometimes tinged red, spreading or reflexed, 16–25 × 10–15 mm, 2·5–3 × sepals, obovate, with apiculus lateral, subacute to obtuse, margin entire or often minutely glandular-denticulate especially around apiculus. *Stamen fascicles* each with 40–65 stamens, longest (10)15–18 mm, long, 0·75–0·85 × petals; anthers yellow to orange-yellow. *Ovary* 5–7 × 3·5–4·5 mm, ± narrowly ovoid-conic; styles (3–)4–6(–8) mm, long, equalling to slightly longer than ovary, free, suberect, outcurved near apex; stigmas truncate to narrowly subcapitate. *Capsule* 9–15 × 8–10 mm, ovoid to narrowly ovoid-conic, turning bright red during maturation. *Seeds* dark orange- to reddish-brown, 1–1·1 mm long, narrowly cylindric, narrowly carinate with terminal expansion, shallowly linear-foveolate. 2n = ?

Forest glades, roadside banks, hillsides among scrub, open stream-sides; 900–3000 m.

China (N. and E. Yunnan, S. Sichuan, SW. Guizhou, Guangxi). Map 17.

Map 17 Sect. 3. *Ascyreia*: 20. *H. subsessile* □, 23. *H. acmosepalum* ●.

CHINA. Yunnan: Likiang range, Long Yü Mtn, Mung Hua [Munghwa], vi.1934, *McLaren's Colls.* L94A (BM, E, K); Cangshan, above Yangbi, Shangchang, 2600 m, 9.v.1981, *Sino-Brit. Exped. Cangshan* 423 (BM, E); near Kunming, Dashao, 2400 m, 26.iv.1981, *Sino-Brit. Exped. Cangshan* K.052 (BM, E); vicinity of Yunnan-sen [Kunming], 1906 ?, *Maire* 136 (BM, E); Ping-pien Hsien, 1500 m, 18.vii.1934, *Tsai* 60972 (BO). Sichuan: Xichang Xian, 2100 m, 23.v.1978, *Zhao* 4577 (SZ). Guizhou: Shui-cheng, outside E. gate, 23.x.1930, *Tsiang* 9442 (E, K). Guangxi: Lingyun, 1100 m, 19.x.1957, *C. C. Chang* 10428 (IBSC).

CULTIVATED. Specimens seen from England (1970; live 1984), Ireland (1967), U.S.A. (1959).

H. acmosepalum appears to be an early offshoot of the line that gave rise to the *H. patulum* and *H. lagarocladum* groups. Its stellate flowers with long stamens and styles and acute sepals, and its bright red young fruits, are reminiscent of *H. kouytchense*; but its erect habit, elliptic to oblong leaves with a marked intramarginal vein, and deep yellow petals are quite distinct and make it easily distinguishable. Its nearest (ancestral) relative appears to be *H. subsessile*, which is more advanced in its shorter stamens and styles and broader sepals, but has a more primitive leaf.

24(35). **Hypericum lagarocladum** N. Robson, **sp. nov.**

H. acmosepalo N. Robson affinis, sed caulibus tenuoribus arcuatis, foliis anguste ellipticis vel oblongo-ellipticis venis lateralibus venam intramarginalem continuum haud formantibus, petalis incurvis, staminibus stylisque brevioribus, inter alia differt. Type: China, Yunnan, Kunming, Qiqu, 8.v.1956, *B.-y. Qiu* 51837 (KUN!, holotype; SZ!, isotype).

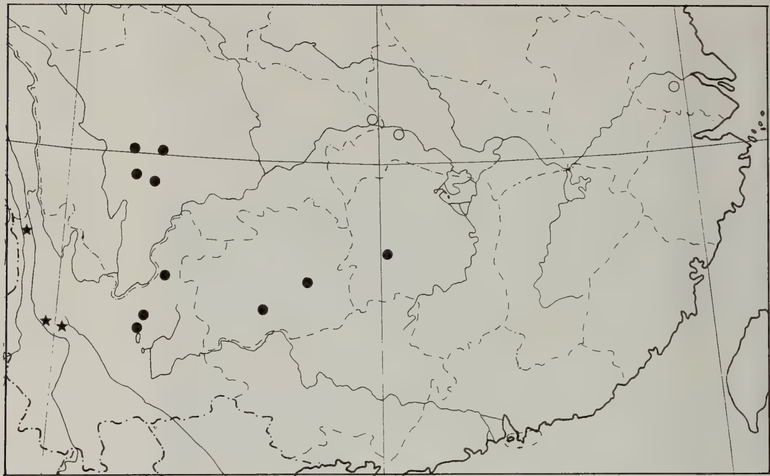
H. hookerianum sensu R. Keller in *Bot. Jahrb.* **33**: 549 (1904); H. Léveillé in *Bull. Soc. bot. Fr.* **54**: 590 (1908); Rehder in Sargent, *Pl. Wils.* **2**: 403 (1915) pro parte, quoad spec. *Pratt* 292; non Wight & Arnott (1834).

Icon: —.

Shrub 0·5–1·5 m tall, with branches arching to spreading, slender, often rather lanky. *Stems* orange, 4-lined, not ancipitous, sometimes becoming 2-lined or terete; internodes 10–33 mm long, shorter than leaves; bark purplish-brown. *Leaves* narrowly petiolate, with petiole 1–1·5 mm long; lamina 18–30(–45) × 6–11(–27) mm, narrowly elliptic or rarely lanceolate-elliptic to ± broadly oblong-elliptic, acute to rounded, margin plane, base cuneate, paler beneath, not glaucous, chartaceous; venation: 3(4) pairs main laterals, lower free or all looped, with subsidiaries and intermediates sometimes almost as strong, but without visible tertiary reticulum; laminar glands dots and short or very short streaks; ventral glands absent or rarely (Hunan) dense. *Inflorescence* 1–3-flowered, from apical node; pedicels 2–7 mm long; bracts reduced, narrowly elliptic to linear, persistent (?). *Flowers* 30–45 mm, in diam., substellate to shallowly cyathiform; buds broadly (or rarely narrowly) ovoid, acute or apiculate to obtuse. *Sepals* (16–)7–10 × (3–)3·5–5·5 mm, free or almost so, imbricate, equal or subequal, erect or apically outcurved in bud, erect or suberect in fruit, ovate to oblong-ovate or lanceolate, acute to obtuse, with margin entire to minutely and ± irregularly denticulate; midrib often obscure, veins not prominent; laminar glands linear, sometimes distally interrupted, *c.* 12–14. *Petals* golden yellow, ± shallowly incurved, 18–23 × 10–15(–18) mm, 2·5–3 × sepals, ± narrowly to rather broadly obovate, with apiculus subterminal, rounded or obsolete; entire or inner margin minutely glandular-denticulate. *Stamen fascicles* each with 40–45 stamens, longest 12–18 mm, long, 0·6–0·7 × petals; anthers yellow. *Ovary* 5–8 × 3–5 mm, narrowly ovoid-conic to ovoid; styles 4–7 mm long, 0·5–0·85 × ovary, free, rather slender, suberect to gradually outcurved, more distinctly outcurved distally; stigmas scarcely capitate. *Capsule* *c.* 12 × 8 mm, ovoid-conic to ovoid. *Seeds* purplish-brown, *c.* 1·4 mm long, narrowly cylindric, shortly apiculate, shallowly carinate, shallowly linear-reticulate. 2n = ?

Roadside banks and grassy slopes; 1900–2550 m.

China (NE. Yunnan, W. Sichuan, Guizhou, W. Hunan). Map 18.



Map 18 Sect. 3. *Ascyreia*: 24. *H. lagarocladum* ●, 25. *H. wilsonii* ○, 27. *H. addingtonii* ★.

CHINA. Yunnan: Lo Shiueh Mtn, 13.iv.1936, *McLaren's colls.* U173 (BM, E); Kunming to to Xiaguan, 260 km, 2400 m, 27.v.1981, *Sino-Brit. Exp. Cangshan* K149 (BM, E). Sichuan: Tianquan Xian, 1500 m, 4.vi.1956, *He* 44213 (SZ); Omei-hsien, 14.vii.1937, *Chien* 6098 (E). Guizhou: Shiheryung to Lungchang Puting, 14.v.1935, *Teng* 0306 (IBSC); Kaili Xian, 19.v.1959, *Cao* 1440 (KUN). Hunan: Qianyang, 4.viii.1953, *Li* 199 (IBSC).

H. lagarocladum is related to *H. acmosepalum* but differs in its more slender, arching stems, thinner, more elliptic and less discolorous leaves without a marked intramarginal vein, erect or suberect sepals, usually shallowly incurved petals, relatively shorter stamens and usually relatively shorter styles. The eastern form (from Guizhou and western Hunan) has an ovoid or ovoid-conic ovary (4·5–6 mm wide) and usually relatively narrow, acute to obtuse leaves, and is related to *H. wilsonii*; the north-western form (from north and east Yunnan and west Sichuan) has a narrowly ovoid-conic ovary (3–4·5 mm wide) and usually relatively broad, obtuse to rounded leaves, and is related to *H. addingtonii*. Apart from the ovary width, which shows a cline, all character ranges seem to overlap; and so it seems undesirable to recognise these populations as subspecies.

The eastern form shows a trend eastward in which the habit becomes more spreading, the sepals narrower, the flowers reduced to one, and the styles shorter. These plants (from Guizhou and Hunan) have in most extreme form the slender, spindly shoots which have suggested the specific epithet and approach *H. wilsonii* most closely. For possible hybrids between *H. lagarocladum* and *H. pseudohenryi*, see p. 284.

25(36). **Hypericum wilsonii** N. Robson

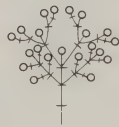
in *J. Roy. Hort. Soc.* **95**: 492 (1970); [Lancaster], *Hilliers' man. trees & shrubs:* 152 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 423 (1973). Type: China, Hubei, Patung Hsien, vii.1907, *Wilson* 2419 (BM!, holotype; E!, K!, isotypes).

H. sp. sensu Rehder in Sargent, *Pl. Wils.* **3**: 452 (1917).

H. kouytchense sensu Milne-Redh. in *Curtis's bot. Mag.* **157**: t. 9345 (1934) et hort., non H. Léveillé. (1904).

Icon: Milne-Redh. in *Curtis's bot. Mag.* **157**: t. 9345 (1934).

Shrub 0·5–1 m tall, spreading, with branches pendulous to somewhat prostrate. *Stems* red, 4-lined and ancipitous when young, becoming 2-lined, eventually terete; internodes 10–45 mm long, shorter than to equalling leaves; bark grey-brown. *Leaves* petiolate, with petiole 0·5–1·5 mm long; lamina 23–55(–60) × (6–)12–29 mm, elliptic or elliptic-lanceolate to lanceolate or ovate-lanceolate, subacute or apiculate-obtuse to rounded, margin plane, base broadly cuneate to rounded, paler or ± glaucous beneath, chartaceous; venation: 4–5 pairs main laterals, with midrib obscurely branched distally, with scarcely visible tertiary reticulum; laminar glands dots and short to longish streaks, ventral glands sparse or absent. *Inflorescence* (1)3–*c.* 22-flowered, from 1(2) node(s), subcorymbiform; pedicels 8–12 mm long; bracts foliar to narrowly lanceolate, deciduous? *Flowers* 40–50(–60) mm in diam., stellate; buds narrowly ovoid, acute to subacuminate. *Sepals* 7–10 × 2–4·5 mm, free, imbricate, equal, ± erect in bud and fruit, lanceolate or narrowly elliptic, acutely acuminate to shortly aristate, with margin entire; midrib conspicuous, veins not prominent; laminar glands linear, *c.* 10. *Petals* golden yellow, not tinged red, spreading, 20–25 × 12–20 mm, 2·5–3 × sepals, obovate, with apiculus subterminal, acute; margin minutely glandular denticulate towards apex or entire. *Stamen fascicles* each with 30–35 stamens, longest 10–15 mm long, 0·35–0·5 × petals; anthers golden yellow. *Ovary* 5–6 × 3–3·5 mm, ± broadly ovoid; styles 7–9 mm long, *c.* 1·5–1·8 × ovary, free, erect, outcurved at apex; stigmas small. *Capsule* 7–11 × 5–6 mm, ovoid. *Seeds* dark orange-brown, narrowly cylindric, scarcely carinate, ± shallowly linear-reticulate. 2n = ?



Cliffs and thickets; (600?)1000–1750 m.

China (W. Hubei, E. Sichuan and possibly Jiangsu; also recorded from Hunan). Map 18.

CHINA. Hubei: S. Patung, 1885–1888, *Henry* 6099 (BM, K); no precise loc., vi.1907, *Wilson* 2216 (E, K). Sichuan: Wushan Hsien, 1000 m, 1907, *Wilson* 256 (seed only); Huidong Xian, 1750 m, 3.vii.1978, *Zhao* 5802 (SZ).

CULTIVATED. Specimens seen from England (1915), Scotland (1977), Ireland (1930–80), France (1929), U.S.A. (1929).

In *H. wilsonii*, the spreading habit developed in the eastern form of *H. lagarocladum* is more pronounced, so that its stems frequently trail over the ground, and it has (i) relatively and absolutely shorter stamens and (ii) a smaller ovary, so that the styles are relatively longer. The typical specimens that I have seen are restricted to a small region in the Yangtze valley near the Hubei–Sichuan border; but Li (ined.) records it from Hunan.

All the cultivated material of *H. wilsonii* would appear to have originated from *Wilson* 256 (see above). *Anon.* 5809, from Jiangsu? (Buyijiao R. area) has narrower petals, relatively longer styles, a subglobose ovary and oblong-elliptic discolorous leaves, all characters that tend towards *H. dyeri*.

26(37). **Hypericum dyeri** Rehder

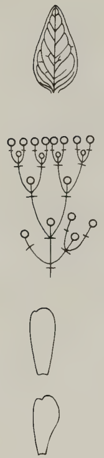
in *J. Arnold Arbor.* **20**: 422 (1939); N. Robson in K. H. Rechinger, *Fl. iranica* **49**: 4 (1968), in *J. Roy. Hort. Soc.* **95**: 490 (1970), in Nasir & Ali, *Fl. W. Pakistan* **32**: 4, f. 1 A–D (1973); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 423 (1973); N. Robson in Hara & Williams, *Enum. fl. pl. Nepal* **2**: 61 (1979). Types: India, Uttar Pradesh, east Kumaon, *Blinkworth* in *Wallich* 4817A (K-W!, lectotype; BM!).

H. govanianum Wallich, *Numer. list.*: No. 4815 (1831), nomen.

H. coriaceum Royle, *Illustr. bot. Himal.*: 131 (1834), nomen, non Blume (1825).

H. lysimachioides Wallich [*Numer. list.*: No. 4817 (1931) nomen] ex Dyer in Hook. f., *Fl. Brit. Ind.* **1**: 254 (1874); Collett, *Fl. simlensis*: 56 (1902); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925); Parker, *For. fl. Punjab, etc.* 2nd ed.: 28 (1934); non Boiss. & Noé (1853). Types as for *H. dyeri*.

H. cernuum sensu Dyer in Hook. f., *Fl. Brit. Ind.* **1**: 253 (1874) pro parte, quoad syn. *H. govanianum*, non *H. cernuum* Roxb. ex. D. Don.

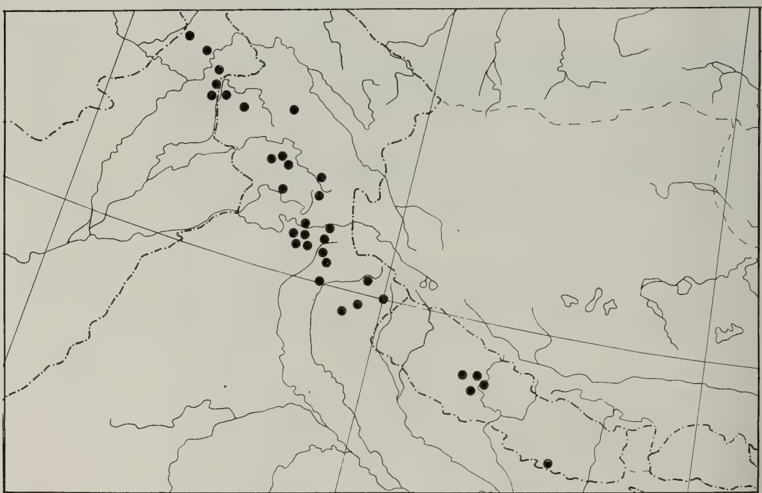


Icon: N. Robson in Nasir & Ali, *Fl. W. Pakistan* 32: 5, f. 1 A–D.

Shrub 0·6–1·2 m tall, with branches ± widely spreading. *Stems* orange to yellow-brown, 2–4-lined and ancipitous when young, soon terete or persistently 2-lined; internodes 10–30(–55) mm, shorter than or very rarely exceeding leaves; bark grey-brown. *Leaves* petiolate, with petiole 1–2 mm long; lamina 10–50(–60) × 5–24(–35) mm, oblong-lanceolate or lanceolate to ovate, acute to apiculate-obtuse or rounded, margin plane, base cuneate to rounded, discolorous, markedly glaucous beneath, chartaceous to papyraceous; venation: 2–3 pairs main laterals, the upper sometimes forming a ± prominent partial inframarginal vein, with midrib pinnately branched, the branches forming a rudimentary reticulum, tertiary reticulum otherwise very rarely visible; laminar glands short streaks and dots; ventral glands dense. *Inflorescence* 1–31(or more)-flowered, from 1–2-nodes, subcorymbiform to broadly pyramidal, without or with 1 pair of branches below; pedicels 6–11(–16) mm long; bracts foliaceous to linear-lanceolate, gradually smaller distally, persistent. *Flowers* (15–)20–30(–35) mm in diam., stellate; buds ovoid, subacute to rounded. *Sepals* 4–12 × 1–2·5(–3) mm, free, imbricate at base, equal, spreading in bud and fruit, narrowly oblong-lanceolate to linear, acute, with margin entire; midrib visible, veins not prominent; laminar glands interrupted-linear, *c.* 6–10. *Petals* bright yellow, not tinged red, spreading, 10–18 × 3–7(–9) mm, *c.* 1·5–2·5 × sepals, oblanceolate, with apiculus subterminal and rounded or absent; margin entire, eglandular. *Stamen fascicles* each with *c.* 20 stamens, longest 8–12(–15) mm long, *c.* 0·7–0·85 × petals; anthers bright yellow. *Ovary* 3·5–5 × 2·8–4 mm, broadly ovoid to subglobose; styles 4–7 mm long, 1·5–2 × ovary, free, suberect or gradually divergent, spreading at apex; stigmas capitate. *Capsule* 7–10 × 5–7 mm, subglobose. *Seeds* dark reddish-brown, *c.* 0·9 mm long, narrowly cylindric, not or narrowly carinate, shallowly linear-foveolate. 2n = 20.

On dry open slopes, steep banks, and cliffs, sometimes in woodland, rarely in forest (central Nepal, atypical); 1300–3000 m.

Nepal (Central, West), India (Bihar, Kumaun to Kashmir), Pakistan (Hazara, Swat, Dir). Map 19.



Map 19 Sect. 3. *Ascyreia*: 26. *H. dyeri* ●.

NEPAL. Central: Kali Gandaki Valley, 1800 m, 31.v.1954, *Stainton, Sykes & Williams* 5478 (BM); Lukarban Khola, W. of Beni, 5.v.1954, *Stainton, Sykes & Williams* 447 (BM). West: near Maikot, 2550 m, *Stainton, Sykes & Williams* 3302 (BM, E).

INDIA. Bihar: Suratpur, x.1942, *Mundkur* 100 (A). Uttar Pradesh: N. Gharwal, Nandagiri Valley, 2460 m, 11.vi.1919, *Osmaston* 1061 (A); Mussoorie, Old Brewery Road, 1950 m, vi.1914, *Anderson* (E). Himachal Pradesh: Simla, Jakko, 27.vi.1916, *Rich* 257 (K); Chamba, Kilor, Bhandal Valley, 2100 m, 30.ix.1919, *Parker* (K). Kashmir: Basaoli [Basoli], 1500 m, 26.vii.1876, *Clarke* 31615 (K); Batol Pass, Jumu Road, *c.* 1800 m, viii.1931, *Stewart* 12991 (A).

PAKISTAN. Hazara: Murree Hills, Changla Gali, *c.* 2100 m, 27.viii.1918, *Stewart* 3910 (A, RAW). Swat: Kulali, *c.* 11 km up Swat R. from Bahrein, *c.* 1650 m, *Rodin* 5608 (RAW). Dir: Gujar to Dir, 2100–2400 m, 30.viii.1962, *Stewart, Nasir & Siddiqi* 1432 (RAW).

CULTIVATED. Specimens seen from Eire (1922), U.S.A. (1921) and St. Helena (1832).

Despite their wide disjunction, *H. dyeri* is clearly related to *H. wilsonii* (q.v.). Presumably the disjunction was caused, or at least widened, by the eruption of the Himalayan massif.

One of the Nepal specimens of *H. dyeri* (*Stainton, Sykes & Williams* 447) has large, thin leaves and relatively long pedicels, and is said to grow 'in forest'.

27(38). **Hypericum addingtonii** N. Robson, **sp. nov.**

H. x *cyathifloro* N. Robson similis, sed foliis latioribus, ovato-lanceolatis vel oblongo-lanceolatis vel elliptico-oblongis, apice acutis vel obtusis vel rotundato-apiculatis, alabastris apice obtusis, sepalis latioribus apice apiculatis vel obtusis vel rotundato-apiculatis, petalis suborbicularibus, ovario ovoideo breviori, differt. Type: cultivated, England, W. Sussex, Fittleworth [ex horto cornubiensi], 6.x.1972, *Addington* (BM!, holotype).

H. leschenaultii sensu hort. pro parte, non Choisy (1821).

Icon: Fig. 17

Shrub 1·5–2 m tall, spreading to 2·5 m wide, with branches arching to spreading. *Stems* yellow-brown, 4-angled but not ancipitous when young, soon terete; internodes 10–50 mm long, shorter than leaves. *Leaves* petiolate, with petiole 1–2·5 mm long; lamina (20–)25–85 × 10–35 mm, elliptic-oblong to ovate-lanceolate or oblong-lanceolate, apiculate or obtuse to rounded, margin plane, base cuneate, paler beneath, not glaucous, chartaceous; venation: 3–4(5) pairs main laterals, all or only distal ones closed, with subsidiaries rarely prominent and tertiary reticulum not visible; laminar glands dots and short streaks; ventral glands absent or rarely sparse. *Inflorescence* 1–3(–5)-flowered from apical node; pedicels 2–10 mm long; bracts reduced, lanceolate, persistent. *Flowers* (30–)50–65 mm in diam., shallowly cyathiform; buds ovoid, obtuse. *Sepals* 7–10 × 4·5–6·2 mm, free, imbricate, sub-equal, erect in bud and fruit, ovate to oblong-ovate or oblong-spathulate, acute or apiculate to obtuse or rounded-apiculate, margin entire or minutely denticulate, sometimes narrowly hyaline; midrib distinct, veins becoming prominent after flowering; laminar glands linear or interrupted, numerous. *Petals* golden yellow, shallowly incurved, (20–)25–32 × (12–)15–32 mm, 3–4 × sepals, broadly obovate to subcircular, with apiculus lateral rounded; margin entire. *Stamen fascicles* each with 40–45 stamens, longest 12–15 mm long, *c.* 0·4 × petals; anthers yellow. *Ovary* 5–7 × 3–5 mm, ovoid; styles 4·5–5(–7) mm, 0·7–0·8(–1) × ovary, free, suberect, outcurving near apex; stigmas scarcely capitate. *Capsule* *c.* 20 × 10–12 mm, ovoid to cylindric-ovoid. *Seeds* dark reddish-brown, 1–1·2 mm long, cylindric, not or scarcely carinate, shallowly linear-reticulate. 2n = 20 ?

Habitat unknown; 1800–3100 m.

China (NW. Yunnan). Map 18.

Fig. 17 *H. addingtonii*: (a) habit; (b) leaf section; (c) flower bud; (d) sepal; (e) petal; (f) stamen fascicle; (g) anthers; (h) capsule (a × 1; b–f, h × 4; g × 20). All *Wayment* s.n.

CHINA. Yunnan: Gongshan [Kungshan] 9.x.1940, *Feng* 8297 (KUN); Shu-yang valley, lat. 25°20′N, 1800 m, 13.v.1913, *Forrest* 9928 (E, K); headwaters of Red River or Menghuaho, from Maokai to Tatsang, 2200 m, 8–12.iv.1922, *Rock* 3030 (EO).

CULTIVATED. England: Hampshire, Ampfield, Hilliers' Jermyns Lane Nursery, 29.vi.1970, *Lancaster* s.n. (BM); Manchester, Fallowfield, Whitworth Lane, Univ. Bot. Dept. Experimental Gdns, 3.vii.1981, *Wayment* s.n. (BM). Also seen elsewhere, e.g. at the Royal Horticultural Society's Garden, Wisley (1983).

H. addingtonii, which occurs only in north-west Yunnan, was probably introduced to cultivation by Forrest and appears to be quite widespread in British gardens. It has been confused (by me as well as others) with *H. leschenaultii* and *H. beanii*; but the chartaceous leaves and sepals, the sepal shape and constantly erect attitude, and the spreading habit are among the characters distinguishing it from *H. leschenaultii*, whilst it differs from *H. beanii* by the spreading habit, the more slender and soon terete stems, and the often larger flowers with much shorter stamens.

H. addingtonii is most closely related to *H. lagarocladum*, in which the stem is often 4-lined, the leaves always broadest at the middle, acute to obtuse and usually smaller, and the flower generally more primitive (i.e. with narrower acute sepals, narrower petals, longer stamens and often narrower ovary and capsule). It shows an unusually wide variation in leaf size (20–85 mm in length). The *Rock* specimen is somewhat atypical, having narrower sepals than usual, reddish stems and a few ventral leaf-glands. In some of these respects it approaches *H. lagarocladum* and in others *H. hookerianum*.

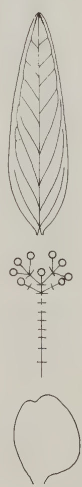
27x(38x). **Hypericum** x **cyathiflorum** N. Robson, **hybr. nov.**

Hybrida hortensis e *Hyperico addingtonii* N. Robson et *H. hookeriano* Wight & Arn. verosimiliter exorta, longitudine staminorum inter eas species media, ad illud foliis sepalisque acutis vel apiculatis, ad hoc foliis angustibus accedens. Standard specimen: Cultivated, Jackman's Nursery, Woking, Surrey, England. 13.vii.1970, *Jackman* s.n. (BM!).

H. 'Lawrence Johnston' hort.
H. patulum 'Gold Cup' Jackman (1952).
H. hookerianum 'Gold Cup' Jackman (*c.* 1960).
H. beanii 'Gold Cup' N. Robson in *J. Roy. Hort. Soc.* **95**: 488, in clav. (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 150 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 406 (1973).

Icon: N. Robson in *J. Roy. Hort. Soc.* **95**: f. 236 (1970).

Shrub up to *c.* 1·5 m tall, with branches widely spreading. *Stems* orange, 4-angled but not ancipitous when young, soon 2-lined, eventually terete; internodes 10–60 mm long, shorter than leaves; bark reddish-brown. *Leaves* rather broadly petiolate, with petiole 1–2·5 mm long; lamina 30–75 × 8–20 mm, lanceolate, acute to apiculate, margin plane, base cuneate, paler beneath, not glaucous, chartaceous; venation: 4–5 pairs main laterals, all free or subdistally closed, with subsidiaries not prominent and obscure tertiary reticulum; laminar glands dots and short streaks; ventral glands absent. *Inflorescence* 1–9-flowered, from 1–3 nodes, subcorymbiform; pedicels 5–10 mm long; bracts reduced, ± narrowly elliptic, persistent. *Flowers* 40–50 mm in diam., cyathiform; buds narrowly ovoid, acute. *Sepals* 6–9 × 3·3–4·5 mm, free, imbricate, subequal, erect in bud and fruit, ovate-lanceolate or elliptic to oblong-spathulate, acute to apiculate-obtuse or rarely rounded-apiculate, margin entire to minutely denticulate, hyaline, sometimes reddish; midrib ± distinct, veins not prominent; laminar glands linear, *c.* 12. *Petals* golden yellow, ± shallowly incurved, 20–30 × 15–19 mm, 2·5–3 × sepals, broadly oblong-obovate, with apiculus subterminal, obtuse; margin entire. *Stamen fascicles* each with *c.* 45 stamens, longest 9–13 mm long, 0·3–0·4 × petals; anthers yellow. *Ovary* 7–8 × 4·5–5 mm, ovoid-conic; styles 4·5–5 mm long, *c.* 0·6 × ovary, free, suberect, outcurved near apex; stigmas truncate. *Capsule c.* 20 × 10 mm, ovoid-conic. *Seeds* not seen. 2n = 30.



Known only in cultivation.

CULTIVATED. England: Wisley, Surrey, Royal Horticultural Society's Garden, 29.vii.1970, *Robson* s.n. (BM); Winchester, Hants, Hilliers' Old Winchester Nursery, 27.vii.1970, *Lancaster* s.n. (BM). Scotland: Benmore, Argyll, Younger Bot. Gard., 4.ix.1977, *Herb. Edinb.* C. 11670 (BM).

H. x *cyathiflorum* was apparently introduced to cultivation by Jackman's of Woking, Surrey, England, about 1952 as *H. patulum* 'Gold Cup'. The name was later (*c.* 1960) changed to *H. hookerianum* 'Gold Cup', probably on account of the terete mature branches; and I (Robson, 1970), on account of its acute to subacute sepals and buds, placed it under *H. beanii*.

The source of Jackman's material has not been located. It may be significant, however, that this plant is grown at Hidcote Manor, Gloucestershire, under the name 'Lawrence Johnston', after the late owner of Hidcote Manor and maker of its garden. A chance seedling originating there might well have been thus named. The chromosome number (2n = 30) suggests that it is a triploid on the base x = 10, and its relatively poor fruiting would tend to support this hypothesis (see also 27xx. *H.* x 'Hidcote'). I have not seen any wild-collected material of this plant, which is strikingly intermediate between *H. addingtonii* and *H. hookerianum*. It is therefore very likely that it arose in cultivation in western Europe, probably in Britain after the introduction of *H. addingtonii* by Forrest (?). As other hybrids between *H. addingtonii* and *H. hookerianum* may be (or may have been) produced, I propose that the plant described above to be known as *H.* x *cyathiflorum* 'Gold Cup'.

27xx(38xx). **Hypericum** x 'Hidcote', **hybr. nov.**

(27x. *H.* x *cyathiflorum* 'Gold Cup' x 14. *H. calycinum*)

H. patulum 'Hidcote Variety' Synge in *J. Roy. Hort. Soc.* **75**: C (1950). Standard specimen: cultivated, England, Surrey, Woking, Chobham, T. Hilling & Co's nurseries, 1.viii.1950, *Anon.* (K!).

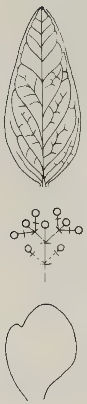
H. patulum 'Hidcote' Plaisted & Lighty in *Nat. hort. Mag.* **38**: 124 (1959) et auct. hort.

H. 'Hidcote' Thomas in *Gdnrs' Chron.* III, **147**: 227, 254t. (1960); N. Robson in *J. Roy. Hort. Soc.* **95**: 491, f. 244 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 151 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 413 (1973); N. Robson in *Bull. Br. Mus. nat. Hist.* (Bot.) **8**: 170 (1981).

H. hookerianum 'Hidcote' I. F. Schneider in *Meded. Inst. Vered. Touinbouwgew.* **252**: 20 (1966), in *Dendrofl.* **2**: 20 (1967).

H. 'Hidcote Gold' sensu hort. amer.

Icones: Thomas in *Gdnrs' Chron.* III, **147**: 227, 254 (1960).



Shrub up to 1·75 m tall, bushy, with branches arching to spreading. *Stems* reddish to orange, 4-angled and slightly ancipitous when very young, usually soon terete or rarely persistently 2–4-lined; internodes 10–40 mm long, usually shorter than leaves; bark reddish-brown. *Leaves* petiolate, with petiole 0·5–2 mm long; lamina 30–60 × 10–25 mm, triangular-lanceolate, acute to obtuse or sometimes slightly mucronate, margin plane, base broadly to rather narrowly cuneate, paler beneath, not glaucous, chartaceous; venation: 3–5 pairs main laterals, all closed, with subsidiaries and lax tertiary reticulum ± conspicuous; laminar glands dots and short streaks; ventral glands rather dense to sparse. *Inflorescence* 1–*c.* 16-flowered, from 1–2 nodes, subcorymbiform; pedicels 6–13 mm long; bracts elliptic to narrowly oblong, eventually deciduous. *Flowers* (35–)40–65 mm in diam., cyathiform; buds broadly ovoid, obtuse to rounded. *Sepals* 8–11 × 6–9 mm, free, imbricate, equal to subequal, erect in bud and fruit, ovate-oblong to broadly elliptic, rounded, margin finely ciliolate or denticulate distally, hyaline; midrib usually obscure, veins not prominent; laminar glands linear, numerous. *Petals* golden yellow, shallowly incurved, 15–35 × 15–25 mm, 2–3 × sepals, obovate, with apiculus lateral, rounded; margin entire. *Stamen fascicles* each with 40–60 stamens, longest 8–12 mm long, 0–35–0·5 × petals; anthers orange. *Ovary* 7–9 × 5–6 mm, ovoid; styles 8–10 mm long, 1–1·5 × ovary, free, erect

or suberect, outcurved near apex; stigmas small. *Capsule* deciduous when still immature. *Seed* not developing. 2n = *c*. 50 (*c*. 48, *c*. 54, 55).

Known only in cultivation.

CULTIVATED. England: Kew, Arboretum Nursery, 8.viii.1959, *Anon.* (K); Wisley, Roy. Hort. Soc's Garden, vii.1966, *Brickell* s.n. (BM). Ireland: Offaly, Birr Castle, 6.x.1980, *Anon.* (DBN). New Zealand: Canterbury, Lincoln, D.S.I.R., 14.i.1980, *Sykes* 2/80 (BM).

Also seen in Scotland and France. Grown also in the U.S.A. and many other countries.

No material of *H.* x 'Hidcote' from natural habitats has been seen; and it appears to be always sterile, the flower dropping after the fruit has begun to swell. Morphologically it is intermediate between *H.* x *cyathiflorum* and *H. calycinum*, and cytologically an origin from these two species with chromosome doubling is possible (*c*.15 + 10 = *c*.25 × 2 = *c*.50). Circumstantial evidence indicates that the cross may have occurred (probably spontaneously) at Hidcote Manor, Gloucestershire, where both suspected parents were and are growing (Robson, 1981). In an attempt to resynthesise *H.* x 'Hidcote', the cross *H.* x *cyathiflorum* 'Gold Cup' ♀ x *H. calycinum* ♂ was made by Miss Julie Westfold in 1984, but the results are not yet available.

H. x 'Hidcote', like most other artificial *Hypericum* hybrids, shows a tendency to produce shoots with variegated leaves. These are narrowly lanceolate, narrower than in *H.* x *moserianum* 'Tricolor', and the whole shoot looks weak and sickly. Plants have nevertheless been grown from cuttings of such shoots and sold by nurseryman as *H.* 'Hidcote variegatum'. It seems unnecessary to encourage the distribution of such a poor plant by formally describing it.

28(39). **Hypericum hookerianum** Wight & Arnott

[in Wight, *Cat. Ind. Pl.*: 20, No. 332 (1833) nomen] *Prodr. fl. penin. ind. or.* **1**: 99 (1834); Wight, *Icon. pl. ind. or.* **3**: t. 959 (1845); Dyer in Hook, f., *Fl. Brit. Ind.* **1**: 254 (1874), excl. var. *leschenaultii*; Gamble, *Fl. pres. Madras* **1**: 70 (1915); Fyson, *Fl. Nilgiri & Pulney hill-tops* **1**: 37 (1915), **2**: 29, t. (1915); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925); *Fl. S. Ind. hill stns* **1**: 47 (1932), **2**: 30 (1932); Y. Kimura in Hara, *Fl. eastern Himalaya*: 210 (1966); Mathew in *Rec. Bot. Surv. India* **20**: 45 (1969); N. Robson in *J. Roy. Hort. Soc.* **95**: 490 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 151 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 414 (1973); N. Robson in Hara & Williams, *Enum. fl. pl. Nepal* **2**: 61 (1979). Type: India, 'Southern Provinces', *Wight* 332 (K!, holotype; E!, isotype).

H. patulum sensu D. Don, *Prodr. fl. nepal.*: 218 (1825), non Thunb. ex Murray (1774).

H. oblongifolium sensu Wallich, *Pl. asiat. rarior.* **3**: t. 244 (1832) et auct. mult., non Choisy (1821).

Norysca hookeriana (Wight & Arnott) Wight, *Illustr. Ind. bot.* **1**: 110 (1840) '*Norisca*'; Blume, *Mus. bot. Lugd. Bat.* **2**: 22 (1856); Y. Kimura in Nakai & Honda *Nova fl. jap.* **10**: 98 (1951).

H. patulum subsp. (γ) *hookerianum* (Wight & Arnott) Kuntze, *Rev. gen. pl.* **1**: 60 (1891).

H. patulum var. *oblongifolium* sensu Koehne, *Deutsche Dendrol.*: 415 (1893), non *H. oblongifolium* Choisy (1821).

H. garrettii Craib in *Kew Bull.* **1913**: 66 (1913). Type: Thailand, Doi Intanon, 2142–2165 m, 12 & 26. x.1910, *Garrett* 67 (K!, holotype; BM!, E!, isotypes).

Norysca urala var. *angustifolia* sensu Y. Kimura in Hara, *Fl. eastern Himalaya,* 2nd Rep.: 82 (1971) pro parte, quoad spec. ex Bhutan.

Icon: Wallich, *Pl. asiat. rarior.* **3**: t. 244 (1832).

Shrub 0·3–2·1 m tall, bushy, round-topped, with branches erect to spreading. *Stems* red to yellowish, 4-lined and ancipitous when young and usually soon terete, or

always terete; internodes 12–60 mm long, shorter than to exceeding leaves; bark grey-brown. *Leaves* petiolate, with petiole 1–4 mm long; lamina (17–)25–78 × (7–)10–32 mm, narrowly lanceolate or oblong-lanceolate to broadly ovate, acute or obtuse to apiculate or rounded, margin plane, base narrowly cuneate to subcordate, paler or ± glaucous beneath, chartaceous; venation: (2)3–4 pairs main laterals, with midrib pinnately branched above, without visible tertiary reticulum; laminar glands short to very short streaks and dots; ventral glands absent or ± dense. *Inflorescence* 1–5-flowered, from apical node, subcorymbiform; pedicels 3–16 mm long; bracts lanceolate or narrowly oblong to obovate-spathulate, deciduous. *Flowers* 30–60 mm in diam., ± deeply cyathiform; buds broadly ovoid to subglobose, broadly obtuse to rounded. *Sepals* 5–10 × 4–8 mm, free, (often broadly) imbricate, subequal, erect in bud and fruit, obovate or obovate-spathulate to subcircular or elliptic or oblong-elliptic, rounded or rarely rounded-apiculate, with margin entire or rarely very finely eroded-denticulate; midrib visible or ± obscure, veins often prominent, especially in fruit; laminar glands linear, sometimes interrupted near apex, numerous. *Petals* deep golden to pale yellow, not tinged red, markedly incurved, 15–30 × 15–25 mm, *c.* 3 × sepals, broadly obovate to subcircular, with apiculus subterminal, obtuse to rounded, or absent; margin entire, eglandular. *Stamen fascicles* each with 60–80 stamens, longest 5–9 mm long, 0·25–0·35 × petals; anthers golden yellow, sometimes tinged red ? *Ovary* 5–7(–8) × 4–5(–6) mm, broadly ovoid, acute; styles 2–4(–7) mm long, 0·35–0·7 (–0·9) × ovary, free, gradually outcurved towards apex; stigmas narrowly capitate. *Capsule* 9–17 × 7–12 mm, ovoid to ovoid-conic. *Seeds* dark reddish-brown, 0·7–1 mm long, cylindric, not or scarcely carinate, shallowly linear-reticulate. 2n = 20?

Dry to moist, open to half-shaded habitats (grassy or rocky slopes or cliffs, thickets, open forest, forest margins); 1200–3000 m.

China (west Yunnan, south-east Xizang [Tibet]), Thailand (north), Burma (north, central, and Mt. Victoria), India (Arunachal Pradesh, Bengal, Meghalaya, Manipur; Mysore, Tamil Nadu), Bhutan, Tibet (south-east), Sikkim, Nepal (east). Map 20.

CHINA. Yunnan: above Yangbi, Ziyang, 2560 m, 10.v.1981, *Sino-Brit. Exped. Cangshan* 469 (BM, E); Xiaguan, Erhai Park, 1950 m, 1.v.1981, *Sino-Brit. Exped. Cangshan* 10 (E).

THAILAND. Northern: Chiang Mai, Doi Inthanon, *c.* 2400 m, 2.v.1921, *Kerr* 5312 (ABD, BM, K); Chiang Rai, Doi Chong, north part, 1850 m, 19.ii.1968, *Hansen & Smitinand* 12674 (AAU, C, E, K).

BURMA. Shan: Gussampo Patmung, Zawgyi Reserve, 2100 m, pre 25.vii.1921, *Rogers* (E). Kachin: hills NW. of Htawgaw, 2400 m, vii.1925, *Forrest* 27024 (A, E, K). Chin: Mt. Victoria, Mindat Ridge, 2250 m, 22.v.1956, *Kingdon Ward* 22262 (BM).

BANGLADESH. Chittagong: Palutalun, Rangbi, 4.viii.1916, *Cowan* 289 (E.).

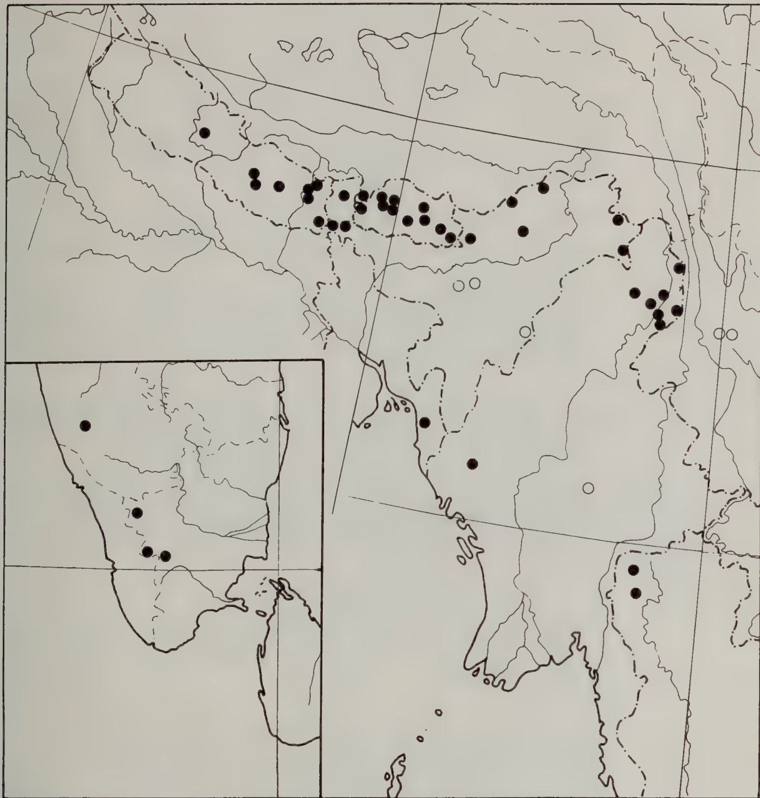
INDIA. Manipur: Sirhoi, on the ridge, 2400 m, 16.vii.1948, *Kingdon Ward* 17796 (BM). Meghalaya: Khasi Hills, Mawphlang, *c.* 1800 m, 28.vi.1953, *Koelz* 33232 (L). Arunachal Pradesh: Delei Valley, 1500–1800 m, 27.vii.1928, *Kingdon Ward* 8484 (K); Pachakshiri, Nyug La, 2700 m, 5.vii.1936, *Ludlow & Sherriff* 1906 (BM); Balipara Frontier, Phutang, 2100 m, 16.v.1935, *Kingdon Ward* 11438 (BM). W. Bengal: Darjeeling, Tonglo, 3000 m, 12.ix.1875, *Clarke* 27530 (BM, K). Mysore: Baba Budan Hills, vi.1847, *Cleghorn* (E). Tamil Nadu: Nilgiri Hills, Ootacamund, Lovedale, 2100 m, x.1889, *Gamble* (K); Anaimalai Hills, pre 1885, *Metz* in *Beddome* 379 (BM); Palnai Hills [Pullney], 1915, *Saulière* 303 (BO).

BHUTAN. North: Shimitang, Tsampa, 3300 m, i.vii.1949, *Ludlow & Sherriff* 19273 (BM). Central: Punakha, Sinchu La, 3000 m, 4.ix.1967, *Bowes-Lyon* 5073 (BM). South: Deothang distr., Tshilingor to Riserboo, 8 km, *c.* 2100 m, 26.vi.1979, *Grierson & Long* 2270 (E).

TIBET. Chayul Chu, 6·4 km below Lung, 2400 m, 10.vii.1936, *Ludlow & Sherriff* 2337 (BM); Pad Lo, near Chumbi, 17.vii.1878, *Dungboo* (BM, K).

SIKKIM. Karponang, 2700 m, 25.vi.1945, *Bor & Kirat Ram* 20604 (L).

NEPAL. East: Barun Khola, 3000 m, 25.xi.1971, *Beer* 12316 (BM). Central:



Map 20 Sect. 3. *Ascyreia*: 28. *H. hookerianum* ●, 28a. *H. hookerianum* 'Charles Rogers' ○.

Khatmandu, Sheopuri Lekh, 1950 m, 19.viii.1954, *Stainton, Sykes & Williams* 6940 (BM).

CULTIVATED. Specimens have been seen from England, Scotland, Wales, and Eire.

H. hookerianum is a variable species related to *H. addingtonii*. From Yunnan, where the form most similar to that species occurs in the Dali region, it shows clinal variation in two directions: (i) through central Burma ('*rogersii*'), Manipur and Meghalaya to the Himalayan range at Bhutan and thence west to central Nepal and east to northern Burma; (ii) through central Burma to northern Thailand ('*garrettii*'), western Burma (Mt. Victoria) and southern India. Both clines show trends from red 4-angled stem, small acute ovate-lanceolate leaves and large flowers with rounded-apiculate sepals (Yunnan) to orange terete stem, large narrowly lanceolate rounded leaves and small flowers with obovate-spathulate rounded sepals. In cline (i) the leaves in the early stages are glaucous beneath with dense ventral glands, whereas the

later stages (most Himalayan specimens) resemble plants from Thailand, Mt. Victoria and southern India in having leaves pale beneath without ventral glands. In Meghalaya there is a local variation in which the leaves become very broadly ovate and the plant looks superficially like *H. bellum* subsp. *latisepalum*.

These variation trends appear continuous, so that, despite the wide range of *H. hookerianum*, no infraspecific taxa can be recognised. Plants have been introduced into cultivation, however, from two distinct parts of the range, viz. the (i) Himalaya and Mt. Victoria (showing advanced characters as described above) and (ii) central Burma. The latter form has been named var. *rogersii* and merits recognition as a cultivar (Map 20):

28a(39a). **H. hookerianum** 'Charles Rogers', **nom. nov.**

H. hookerianum [var.] *rogersii* hort., nomen; Thomas in *Gdnrs' Chron.* III, **147**: 254 (1960).
H. rogersii hort., nomen.
H. hookerianum 'Rogersii' N. Robson in *J. Roy. Hort. Soc.* **95**: 484 (1970); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 415 (1973), nom. illegit. in forma latina. Standard specimen: [cult. ex ?] Burma, Shan State, Gussampo Patmung, Zawgyi Reserve, *C. G. Rogers* s.n. (E!).

Icon: —.

Stem stout, more persistently 4-angled than in the type; *leaves* oblong-ovate to broadly ovate, acute to obtuse; *flowers* 1–3, 40–60 mm in diam., on stout pedicels; *sepals* subcircular to obovate-spathulate, becoming markedly ribbed.

H. hookerianum has been confused with *H. choisianum*, as they both occur in similar habitats in the eastern and central Himalaya. They are, however, nearly always easily distinguishable morphologically (see p. 273); and *H. hookerianum* occurs at lower, though overlapping, altitudes (1200–3300 m as against 2400–4800 m for *H. choisianum* in the same area).

29(40). **Hypericum lacei** N. Robson, **sp. nov.**

H. henryi H. Léveillé & Vaniot affinis, sed foliis oblongis vel ovato-oblongis, staminis quam petalis pro ratione brevioribus, staminis et stylis et capsulis longioribus, differt. Type: Burma, Ruby Mines Distr., Kyatpyin, 22.x.1912, *Lace* 6275 (K!, holotype; E!, isotype).

Icon: Fig. 18.

Shrub, with stems probably erect, not or weakly (?) frondose. *Stems* orange, 4-lined and ancipitous when young, eventually terete; internodes 10–20 mm long, shorter than leaves; bark reddish-brown. *Leaves* petiolate, with petiole *c.* 1 mm long; lamina 25–51 × 8–18 mm, oblong to elliptic-oblong, apiculate-obtuse, margin plane, base cuneate, densely glaucous beneath, chartaceous; venation: 2–3 pairs main laterals from near base, innermost joining upper laterals to becoming incomplete and ± undulating intramarginal vein, all rather dark (when dry), without visible tertiary reticulum; laminar glands very short streaks and dots; ventral glands dense. *Inflorescence* 1–6-flowered, from one node, with short apical internode, subcorymbiform; pedicels 6 mm long; bracts narrowly oblong to lanceolate, deciduous. *Flowers* 40–50 mm in diam., shallowly cyathiform; buds ovoid, subacute to obtuse. *Sepals* 5–6 × 3–5 mm, free, imbricate, ± unequal, erect in bud and fruit, elliptic to obovate, obtuse to rounded, usually apiculate, with margin hyaline and minutely eroded-denticulate near apex; midrib sometimes apparent, veins not prominent; laminar glands linear or interrupted, numerous. *Petals* golden yellow, slightly incurved, 20–25 × 15–17 mm, *c.* 4 × sepals, obovate, with apiculus subterminal, rounded, margin entire, with a row of inframarginal gland dots. *Stamen fascicles* each with *c.* 50 stamens, longest 9–12 mm long, *c.* 0·35–0·5 × petals; anthers yellow. *Ovary* 6–7 × 4–5 mm, broadly ovoid to ovoid-conic; styles 5–6 mm long, 0·75 × to almost as long as ovary, free, outcurved towards apex; stigmas small. *Capsule* 16–20 × 8–10 mm, ovoid-conic. *Seeds* unknown. 2n = ?

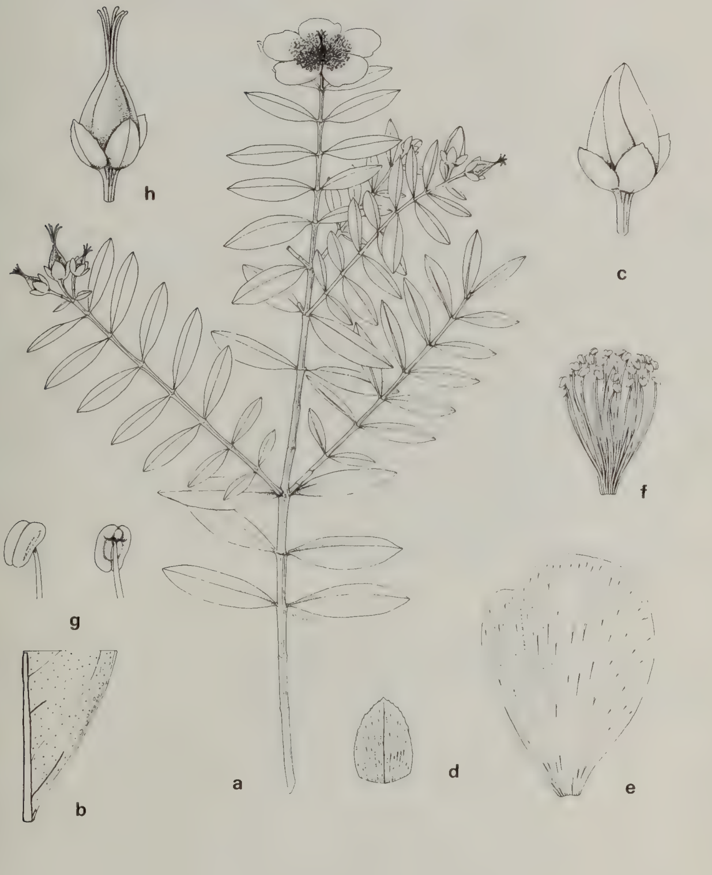
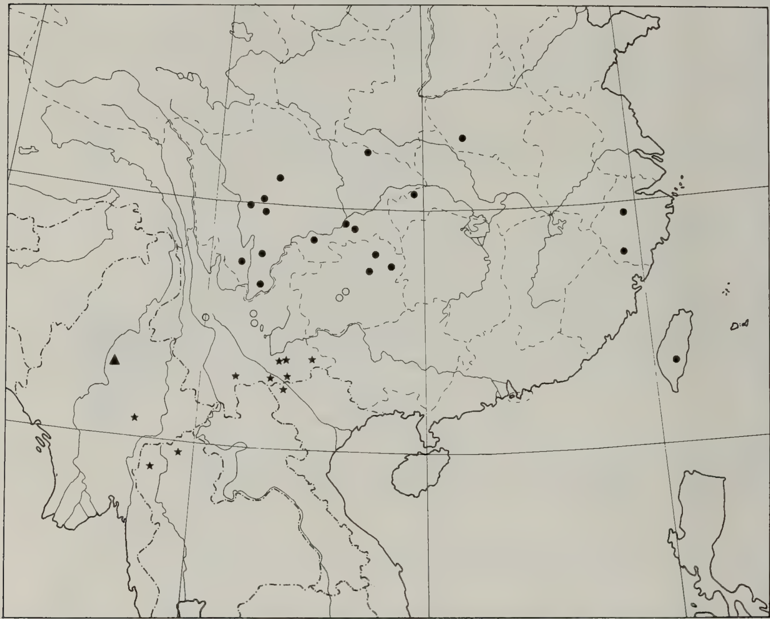


Fig. 18 *H. lacei*: (a) habit; (b) leaf section; (c) flower bud; (d) sepal; (e) petal; (f) stamen fascicle; (g) anthers; (h) capsule (a × 1; b–f, h × 4; g × 40). All *Lace* 6275.

Habitat unknown.

Burma (Shan State). Map 21.
BURMA. Shan: Ruby Mines Distr., Kyatpyin, 22.x.1912, *Lace* 6275 (type); Upper Burma, pre-1897, *Burke* 346 (E).

H. lacei is an apparently narrowly localised species that resembles *H. henryi* most closely in general; but, in its oblong to elliptic-oblong leaves and square (i.e. not remaining ancipitous) young stems, it is nearer *H. lagarocladum* and *H. acmosepalum*. It is thus clearly a relict species.



Map 21 Sect. 3. *Ascyreia*: 29. *H. lacei* ▲, 30a. *H. henryi* subsp. *hancockii* ★ (part; see also Maps 22, 23), 30b. *H. henryi* subsp. *henryi* ○, 31. *H. patulum* ●.

30(41). **Hypericum henryi** H. Léveillé & Vaniot

in *Bull. Soc. bot. Fr.* **54**: 591 (1908): Lauener in *Notes Roy. bot. Gdn. Edinb.* **27**: 3 (1966). Type: China, Guizhou, 'environs de Kouy-Yang, dans la montagne', *Bodinier* 1933 (E!, holotype).

H. patulum sensu N. Robson in *J. Roy. Hort. Soc.* **95**: 491 (1970) pro parte quoad syn. *H. henryi*, non Thunb. ex Murray (1784).

Shrub 0·5–3 m tall, bushy, with stems erect to arching, not or weakly (?) frondose. *Stems* reddish to yellowish, 4-lined and ancipitous when young, usually eventually 2-lined or terete; internodes 10–20 mm long, usually shorter than leaves; bark reddish-brown. *Leaves* subsessile or with petiole to *c.* 1 mm long; lamina 10–40 × 4–16 mm, narrowly elliptic or elliptic-oblong to lanceolate or ovate, acute to obtuse

or more rarely rounded, margin plane, base angustate or cuneate to rounded, densely glaucous beneath, chartaceous; venation: 2–3(4) pairs main laterals, with midrib branched distally, without or with scarcely visible lax tertiary reticulum; laminar glands streaks and dots; ventral glands sparse to dense. *Inflorescence* 1–5(–7)-flowered, from 1–2 nodes, subcorymbiform, usually with short apical internode, sometimes with 1(2)-flowered branches from middle region of stem; pedicels 4–7 mm long; bracts narrowly oblong to lanceolate, deciduous. *Flowers* 15–52 mm in diam., stellate-incurved to cyathiform; buds broadly ovoid to globose, subacute to rounded. *Sepals* 4–9 × 2·5–6 mm, free, imbricate, unequal, erect or (?) rarely ± spreading bud and fruit, oblong or elliptic to obovate-spathulate or broadly ovate or circular, acute (rarely) or apiculate to obtuse or rounded, with margin entire or ± eroded-denticulate, hyaline; midrib distinct or not, veins not or rarely slightly prominent; laminar glands linear to punctiform, numerous; intramarginal glands dense. *Petals* golden to pale yellow, sometimes tinged red, ± spreading or incurved, 8–25 × 6–15 mm, 2–4 × sepals, narrowly to broadly obovate, with apiculus lateral, rounded to obscure; margin entire, with a row of inframarginal gland dots. *Stamen fascicles* each with (30–)40–60 stamens, longest 5–13 mm long, *c.* 0·5 × petals; anthers deep yellow. *Ovary* 3·5–7 × 2·5–5·5 mm, ± broadly ovoid; styles 2·5–6 mm long, 0·7–1·2 × ovary, erect, outcurved towards apex; stigmas scarcely capitate. *Capsule* 9–12 × 8–10 mm, narrowly ovoid-pyramidal to subglobose. *Seeds* dark brown, 1–1·2 mm long, cylindric, not or scarcely carinate, shallowly linear-foveolate. 2n = ?

In dry, usually open habitats (slopes, thickets, open forest); 1300–3314 m.

China (Yunnan, west Guizhou, south Sichuan), Vietnam (north), Burma (Shan, Kachin), Thailand (north), Indonesia (north Sumatra). Maps 21–23.

H. henryi is the basic member of the *patulum* group (Spp. 33–35), the form of subsp. *hancockii* from southern Yunnan being the most closely related to *H. lacei* and *H. acmosepalum*; but it is very variable and not easy to differentiate from *H. patulum* and *H. uralum*. Indeed it would be possible to treat it as one very variable species (*H. patulum*), with five subspecies. In view of the nomenclatural history of the group, however, it seems preferable to recognise three species (*H. henryi, H. patulum,* and *H. uralum*), two of the subspecies of *henryi* forming intermediate taxa between *H. henryi* subsp. *hancockii* and the other species. Thus subsp. *hancockii* (southern Yunnan, adjacent Burma, Vietnam and Thailand, and northern Sumatra) is linked northeastwards to *H. patulum* by subsp. *henryi* and northwestwards to *H. uralum* by subsp. *uraloides*.

30a(41a). **Hypericum henryi** subsp. **hancockii** N. Robson, **subsp. nov.**

a subsp. *henryi* sepalis integris, acutis vel rotundatis, foliis plerumque anguste ellipticis vel lanceolatis, acutis vel obtusis, differt. Type: China, Yunnan, Mengtze, 1895, *Hancock* Kew 116 (K!, holotype and isotype).

H. garrettii Craib in *Kew Bull.* **1913**: 66 (1913) pro parte, quoad specim. *Kerr* 6300.
H. garrettii var. *ovatum* Craib, *Fl. siam. enum.* **1**: 111 (1925). Type: Thailand, Payap. Mûang Fāng, Doi Pahom Pok, *c.* 2400 m, 2.iv.1921, *Kerr* 5188 (K!, holotype; ABD!, BBK!, BM!, E!, isotypes).

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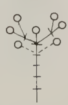

Stems erect, 4-lined and ancipitous at first, sometimes becoming 2-lined. *Leaves* subsessile to shortly petiolate; lamina 15–40 × 5–16 mm, narrowly elliptic or lanceolate to ovate-oblong or rarely ovate, acute to obtuse, base angustate to rounded. *Inflorescence* 1–6-flowered. *Flowers* 25–50 mm in diam., stellate-incurved to cyathiform; buds ovoid to globose, subacute to rounded. *Sepals* (at least the outer) broadly elliptic or broadly oblong to circular or very rarely obovate-spathulate or apiculate, entire. *Petals* 14–25 × 10–15 mm, narrowly to broadly obovate. *Ovary* 5–6 × 4 mm, ovoid; styles 4–6 mm long, 0·8–1·2 × ovary. *Capsule* 10–14 × 6–9 mm narrowly ovoid-pyramidal to broadly ovoid.

Map 22 Sect. 3. *Ascyreia*: 30a. *H. henryi* subsp. *hancockii* ★ (part; see also Maps 21, 23).

China (south Yunnan), Vietnam (north), Burma (Shan), Thailand (north), Indonesia (north Sumatra). Maps 21–23.

CHINA. Yunnan: Xichou [Hsichou], 1500–1700 m, 16.ix.1960, *Wen* 60–0072 (KUN); Chihtsun, 26.vii.–, *Henry* (K); Jingping [Chinping], 1960 m, 11.v.1956, *?* 1158 (KUN); Szemao, 1800 m, 6.x.1899, *Wilson* in Hb. Hong Kong 2751 (K).

VIETNAM. North: Sa Pa [Cha Pa], 1500 m, 26.x.1963, *Przybylski* 135 (K).

BURMA. Shan: Taunggyi, 1500 m, 6.x.1899, *Dickason* 938 (A).

THAILAND. Northern: Chiang Mai, Doi Inthanon, Doi Angkā, *c.* 2000 m, 14.viii.1922, *Kerr* 6300 (ABD, BM, K); Chiang Rai, Doi Pahom Pok, below summit, NW. of Phan, 2000–2350 m, 13.ix.1967, *Iwatsuki, Fukuoka & Chitayungkun* T. 9690 (AAU, K).

SUMATRA. Atjeh: Laut Poepandji, 1900 m, 3–4.ix.1934, *v. Steenis* 6528 (A, L, SING). Utara: Mt. Tandikat, N. of Kandang Empat, 1700–2400 m, 24.v.1955, *Meijer* 3937 (L.). Barat: Korinchi Peak [Koerintji], 2190 m, iv.1914, *Robinson & Kloss* 105 (BM, K, SING, US).

NEW ZEALAND (naturalised). South Island: West Coast near Ross, 21.ii.1947, *Healy* H. 252 (BM).

CULTIVATED. Scotland: Edinburgh, Roy. Bot. Gard., ex seed *Wang & Liu* 85065 [Yunnan, Pingpien, 1300 m, 22.xi.1940], 25.ix.1977, *C.* 11659 (BM, E). See note below.

Tsai 62615, *Mao* 3171 and *Wang & Liu* 85065 (all from the Pingpien area) are morphologically intermediate between subsp. *hancockii* and subsp. *henryi*.

30b(41b). **Hypericum henryi** subsp. **henryi**

H. patulum sensu N. Robson in *Yb. int. Dendr. Soc.* **1980**: 141 (1981).

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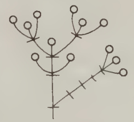

Stems erect to arching or divaricate, ± persistently 4-lined, ancipitous. *Leaves* shortly petiolate; lamina 15–30 × 6–17 mm, ovate-lanceolate or rarely elliptic to broadly ovate, acute (or rarely apiculate) to rounded, base cuneate to rounded. *Inflorescence* 1–7-flowered. *Flowers* 20–35 mm in diam., cyathiform; buds ovoid to subglobose, obtuse to rounded. *Sepals* broadly oblong or broadly elliptic to broadly ovate or circular, apiculate or rounded, subentire to denticulate, erect. *Petals* 10–20 × 8–14 mm, broadly obovate. *Ovary* 4·5–5·5 × 3·5–5 mm, broadly ovoid to subglobose; styles 4–5 mm long, *c.* 0·9 × ovary. *Capsule* 10–14 × 8–10 mm, broadly ovoid.

China (central and east Yunnan, Guizhou). Map 21.

CHINA. Yunnan: Lo Shiueh Mtn, viii.1937, *McLaren's colls* U 124 (BM, E); N. end of Cangshan, road to Huadianba, 2400 m, 17.v.1981, *Sino-Brit. Exped. Cangshan* 264 (E); near Kunming, Hua Hong Dong, 2000 m, 26.iv.1981, *Sino-Brit. Exped. Cangshan* K. 037 (E); Luquan [Luchuan], 2600 m, 25.x.1940, *Zhang* 0324 (KUN). Guizhou: Pin-fa [Pin-pa], 11.viii.1908, *Cavalerie* 3317 (BM, E, K) (see also type).

CULTIVATED. Specimens seen from England (1982), Scotland (1977), and the U.S.A. (California, 1959).

Some of the plants from the Kunming region (e.g. *Sino-Brit. Exped. Cangshan* K106), tend towards *H. patulum* morphologically; but they have tall, arching, 4-lined stems and ovate-lanceolate rather than oblong-lanceolate leaves.

30c(41c). **Hypericum henryi** subsp. **uraloides** (Rehder) N. Robson, **stat. nov.**

H. uraloides Rehder in Sargent, *Pl. Wilson.* **3**: 452 (1917). Type: China, Sichuan, banks of Min River, vi.1903, *Wilson* 3258 (A, holotype; BM!, E!, isotypes).

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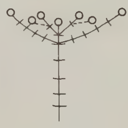


Stems erect to arching or distally frondose, ± persistently 4-lined, ancipitous. *Leaves* subsessile to shortly petiolate; lamina 10–27 × 3–10(–12) mm, narrowly elliptic or narrowly lanceolate to ovate-lanceolate, acute to rarely obtuse, base angustate to cuneate or rarely rounded. *Inflorescence* 1–3-flowered. *Flowers c.* 12–40 mm in diam., stellate-incurved to cyathiform; buds ovoid, subacute or obtuse. *Sepals* elliptic to oblanceolate or narrowly oblong, subacute or apiculate-obtuse to rounded, entire. *Petals* 10–15 × 5–12 mm, broadly obovate, sometimes pale yellow. *Ovary* 4–7 × 2·5–5 mm, ovoid-pyramidal to subglobose; styles 2–5 mm long, 0·5–1 × ovary. *Capsule* 8–11 × 6–8 mm, broadly ovoid-pyramidal to globose.

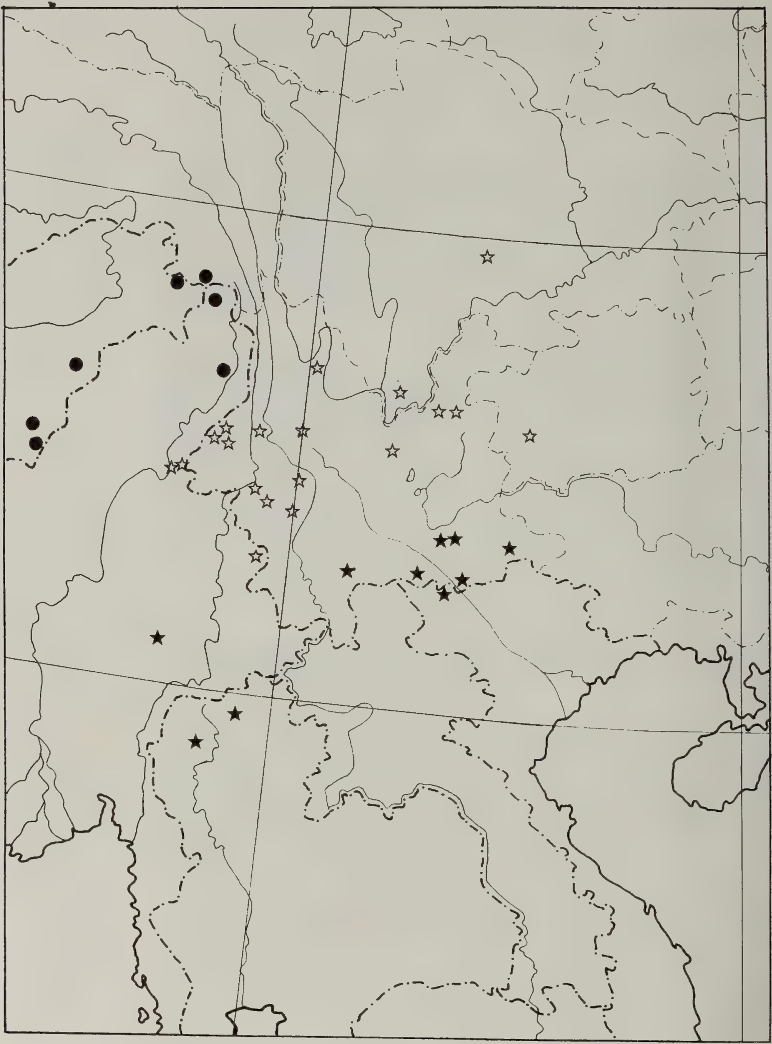
China (north Yunnan, south Sichuan, west Guizhou), Burma (Kachin). Map 23.

CHINA. Yunnan: NE. of Tengyueh [Tengchung], 1800 m, vii.1912, *Forrest* 8626 (E, K); Changning, 2000 m, 11.viii.1960, *Tong* 6003 (KUN); Cangshan, above Yangbi, Zhaimen, 2400 m, 6.v.1981, *Sino-Brit. Exped. Cangshan* 280 (E); Lüchuan, 1700 m, 17.ix.1973, *Tao* 90 (KUN); Lo Shiueh Mtn, viii.1937, *McLaren's colls* U124 (BM, E). Sichuan: Miyi Xian, 16.vi.1958, *Chen et al.* 10204 (SZ); see also type. Guizhou: Pu'an, 1800 m, 7.ix.1959, *An* 1329 (KUN).

BURMA. Kachin: Bhamo, 30.ix.1908, *Cubitt* s.n. (E).

CULTIVATED. England: Hampshire, Chandler's Ford, seed ex *Sino-Brit. Exped. Cangshan* 264 [Yunnan, Cangshan, above Yangbi, Mofanygou, 2400 m, 26.iv.1981], viii.1983, *Lancaster* s.n. (BM).

The type of subsp. *uraloides* is smaller in all its parts and more delicate than the other



Map 23 Sect. 3. *Ascyreia*: 30a. *H. henryi* subsp. *hancockii* ★ (part; see also Maps 21, 22), 30c. *H. henryi* subsp. *uraloides* ☆, 32. *H. uralum* ● (part: see also Map 24).

specimens, and its locality (though imprecise – Min River) is further north than their area. There seems to be no reason, however, to doubt that it and they belong to the same taxon.

31(42). **Hypericum patulum** Thunb. ex Murray

Syst. veg. 14th ed.: 700 (May–June, 1784); Thunb., *Fl. jap.*: 295 (Aug. 1784); *Icon. pl. jap.* Dec. sec.: t. 7 (1800); Choisy, *Prod. monogr. fam. Hypéric.*: 41 (1821), in DC., *Prodr. syst. nat. regni veg.* **1**: 545 (1824) pro parte excl. syn. et var., in Zollinger, *Syst. Verz. Fl. Ind. Archip.* **1/2**: 151 (1854) pro parte, quoad spec Jap.; Treviranus, *In Hyper. gen. sp. animad*: 8 (1861); Maxim. in *Bull. Acad. Imp. Sci. St. Petersb.* **27**: 429 (1882) et *Mél. biol.* **11**: 161 (1882), pro parte excl. syn. Ind.; Hemsley in *J. Linn. Soc.* **23**: 73 (1886) pro parte excl. syn.; Franchet, *Pl. delavayi*: 103 (1889); Kuntze, *Rev. gen. pl.* **1**: 60 (1891) pro parte quoad subsp. *normale*; Koehne, *Deutsche Dendrol.*: 415 (1893); R. Keller in *Bull. Herb. Boiss.* **5**: 638 (1897); Diels in *Bot. Jahrb.* **29**: 476 (1900); H. Léveillé in *Bull. Soc. bot. Fr.* **53**: 499 (1906), in op. cit. **54**: 591 (1908); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.*, 2nd ed. **21**: 176 (1925) pro parte; Rehder in *J. Arn. Arbor* **15**: 100 (1934); Y. Kimura in *Bot. Mag., Tokyo* **54**: 88 (1940); Lauener in *Notes Roy. bot. Gdn. Edinb.* **27**: 4 (1966); N. Robson in *J. Roy. Hort. Soc.* **95**: 491 (1970) pro parte, excl. syn. *H. henryi*; [Lancaster], *Hilliers' man. trees & shrubs*: 152 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 421 (1973); N. Robson in *J. Jap. Bot.* **52**: 278, f. 2 (1977). Type: Japan: 'Crescit in insula Nipon, saepe cultum, alibique', *Thunberg* (UPS, holotype).

Norysca patula (Thunb. ex Murray) J. Voigt, *Hort. suburb. Calcutta*: 90 (1845); Blume, *Mus. bot. Lugd. Bat.* **2**: 23 (1856); Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 99, f. 41 (1951).

Eremanthe patula (Thunb. ex Murray) K. Koch, *Hort. dendrol.*: 65 (1853).

H. gumbletonii Lavallée, *Arb. segrez.*: 25 (1877), nomen.

H. uralum sensu Hance in *J. Bot., Lond.* **16**: 104 (1878), non *H. uralum* Buch.-Ham. ex D. Don (1823).

H. pseud-patulum hort. in *Gdnrs' Chron.* II, **17**: 149 (1882), in synon.

H. patulum subsp. (α) *normale* Kuntze, *Rev. gen. pl.* **1**: 60 (1891). Type as for *H. patulum* Thunb. ex Murray.

H. hookerianum sensu R. Keller in *Bot. Jahrb.* **33**: 549 (1904), non Wight & Arnott (1834).

H. argyi H. Léveillé & Vaniot in *Bull. Soc. Bot. Fr.* **54**: 591 (1908); H. Léveillé, *Fl. Kouy-Tcheou*: 198 (1914), in *Mem. R. Acad. Cienc. Artes Barcelona* III, **12**: 553 (1916). Type: China, Kiang-sou [Jiangsu], *d'Argy* (E!, holotype).

Komana patula (Thunb. ex Murray) Y. Kimura ex Honda, *Nomina pl. jap.*: 509 (1939); Hisauchi, *Kika-syokubutsu*: 179 (1950).

Icon: Y. Kimura in Nakai & Honda, *Nova Fl. Jap.* **10**: 100, f. 41 (1951).

Shrub 0·3–1·5(–3) m tall, bushy, with branches spreading, sometimes weakly frondose. *Stems* reddish to orange, 4-lined or 4-angled when young, soon 2-lined, sometimes eventually terete; internodes 8–40 mm long, shorter than or rarely exceeding leaves; bark greyish-brown. *Leaves* petiolate, with petiole 0·5–2 mm long; lamina 15–60 × 5–30 mm, lanceolate or oblong-lanceolate to ovate or oblong-ovate, obtuse to rounded, always apiculate, margin plane, not incrassate, base narrowly or broadly cuneate to shortly angustate, rather glaucous beneath, chartaceous; venation: 3 pairs main laterals, with midrib branched distally and scarcely visible lax tertiary reticulum; laminar glands short streaks and dots; ventral glands ± dense. *Inflorescence* 1–15-flowered, from 1–2 nodes, corymbiform, sometimes with short apical internode, sometimes with 1–3-flowered branches from middle of stem; pedicels 2–4(–7) mm long; bracts narrowly elliptic to narrowly oblong, deciduous. *Flowers* 25–40 mm in diam., ± cyathiform; buds broadly ovoid, obtuse. *Sepals* 5–10 × 3·5–7 mm, free, ± imbricate, subequal or unequal, erect in bud and fruit, broadly ovate or broadly elliptic or subcircular to oblong-elliptic or obovate-spathulate, obtuse to rounded or retuse and usually apiculate, with margin finely

eroded-denticulate to ciliolate, hyaline, often reddish; midrib often distinct, veins not or slightly prominent; laminar glands linear, numerous. *Petals* golden yellow, not tinged red, ± incurved, 12–18 × 10–14 mm, 1·5–2·5 × sepals, oblong-obovate to broadly obovate, with apiculus lateral, ± rounded to obsolete; margin entire or slightly eroded-denticulate, with a row of inframarginal gland dots. *Stamen fascicles* each with *c.* 50–70 stamens, longest 7–12 mm long, 0·4–0·5 × petals; anthers bright yellow. *Ovary* 5–6 × 3·5–4 mm, ± broadly ovoid; styles 4–5·5 mm long, 0·75–0·95 × ovary, ± erect, outcurved towards apex; stigmas not or scarcely capitate. *Capsule* 9–11 × 8–10 mm, broadly ovoid. *Seeds* dark brown, 1–1·2 mm long, ± cylindric, not or scarcely carinate, shallowly linear-foveolate, 2n = 36? (record is probably based on a misidentification, see Robson (1981: 150–151)).

In dry, open habitats (thickets, scrubby slopes, cliffs); (300) 450–2400 m.

China (native in north Guizhou, Sichuan; probably introduced in other parts of China, certainly introduced in Taiwan, Japan, and South Africa (Natal); specimens seen from Shaanxi, Jiangsu, Anhui, Zhejiang, Fujian, and Guangxi; also recorded from Hunan, Hubei, and Jiangxi). Map 21.

CHINA. Sichuan: cliffs of R. Yangtze above Chungking, 2.vi.1903, *Wilson* 3261 (BM, K); Mt. Omei, x.1980, *Lancaster* 623 (BM); Nanchuan Xian, 1120 m, 19.ix.1957, *Xiong & Li* 93606 (SZ); Huidong Xian, 1750 m, 3.vii.1978, *Zhao* 5801 (SZ). Guizhou: Tsunyi Hsien, Liang Feng Yah, 1100 m, 19.vii.1931, *Steward, Chiao & Cheo* 5 (BM, E, K, L). Guangxi: Fabao, 1001 m, 5.xii.1958, *Chang* 13767 (IBSC). Shaanxi: Hugiaba, i.1936, *Fenzel* 1018 (W). Jiangsu: no precise locality or date, *d'Argy* (E). Anhui: no precise locality, comm. viii.1929, *Chang* 1885 (K). Zhejiang: Chungshan Hsien, 40 li W. of Wenchow, 250–450 m, 8.vi.1924, *Ching* 1885 (E, K). Fujian: Nanjing, 17.v.1959, *Huang* 190370 (IBSC).

TAIWAN (naturalised). Chiayi: A-li-shan, road to Museum, 2200 m, 19.viii.1966, *v. Steenis* 20922 (L).

JAPAN (cultivated and naturalised). Kyushu: Fukuoka Pref., Kasuya Co., Hakozaki, 2.vi.1965, *Ichikawa* 188 (A). Honshu (Central), Kinki: Prov. Kii, Hashimoto, between Yatate and Hosokawa, 400 m, 3.vii.1972, *Tamura* 24686 (E). Honshu (Central), Chubu: Sagami, Mt. Hakone, 14.vi.1907, *Sakurai* s.n. (H). Honshu (Central), Kanto: environs de Yokohama, *c.* 1904, *Borel* (G).

NATAL (naturalised). Mpendhle district, Carters' Nek on Nottingham–Underberg road, *c.* 1830 m, 24.xii.1982, *Hilliard & Burtt* 16088 (BM).

CULTIVATED. Specimens seen from China, Japan, Taiwan, England, Scotland, Ireland, France, Germany, Austria, Italy, Switzerland, Ecuador (also naturalised), and Colombia.

H. patulum has a more northern distribution than *H. henryi* subsp. *henryi*, from which it can be distinguished by the more spreading habit, 2-lined stems, oblong-lanceolate to ovate rather than elliptic or ovate-lanceolate to ovate leaves, and usually by the smaller capsules. It was introduced to Britain from Nagasaki by Oldham in 1862 (Robson, 1970).

H. patulum is less hardy in Europe than species such as *H. pseudohenryi* or *H. forrestii*. These species grow at higher altitudes than *H. patulum* and were introduced to cultivation later, when botanical collectors penetrated further into the mountainous regions of Yunnan and Szechwan. Most of them were at first regarded as 'improved', hardier versions of *H. patulum*, and were named as varieties of that species. However, they have all proved to be specifically distinct, and not even closely related to it.

31x(42x). **Hypericum** x **moserianum** Luquet ex André

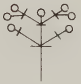
(31. *H. patulum* × 14. *H. calycinum*)

Revue hort. **61**: 463 (1889) ('*Moserianum*'); Plaisted & Lighty in *Nat. hort. Mag.* **38**: 124 (1958); Thomas in *Gdnrs' Chron.* III, **147**: 227 (1960); Milano in *Publs Inst. Bot. agr. Argentina* **8**, 128: 18, f. 5 (1961); Fosberg in *Occ. Pap. B.P. Bishop Mus.* **24**: 21 (1969); Robson in *J. Roy. Hort. Soc.* **95**: 491 (1970); [Lancaster], *Hilliers'*

man. trees & shrubs: 151 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 420 (1973). Type ?: 'Seedling from *H. patulum*', Moser's nursery, Versailles, x.1887, *Herb. Nicholson* (K!, isotype ?).

Icon: Thomas in *Gdnrs' Chron.*, III, **147**: 227 (1960).

Shrub 0·3–0·5(–0·7) m tall, bushy, semi-evergreen, with branches spreading, arching, not very frondose. *Stems* red, 4-lined when young, soon 2-lined to terete except immediately below nodes (4-lined); internodes 8–43 mm, shorter than to exceeding leaves; bark greyish-brown. *Leaves* petiolate, with petiole 1–2·5 mm long; lamina 22–60 × 7–36 mm, oblong-lanceolate or rarely lanceolate to oblong-ovate or ovate, acute to rounded-apiculate or very rarely rounded, margin plane, not incrassate, base cuneate to rounded, paler beneath, not glaucous, subcoriaceous; venation: 4 pairs main laterals, with midrib branched distally, and distinctly visible lax tertiary reticulum; laminar glands medium to short streaks and dots; ventral glands ± dense. *Inflorescence* 1–8-flowered, from 1–2 nodes, corymbiform, sometimes with shorter apical internode, without flowering branches from middle part of stem; pedicels 2–5 mm long; bracts narrowly elliptic to narrowly oblong, deciduous. *Flowers* 45–60 mm in diam., stellate to slightly cyathiform; buds broadly ovoid to subglobose, obtuse. *Sepals* 7–10 × 6–10 mm, free, imbricate, unequal, broadly oblong-elliptic to subcircular, rounded, erect in bud, ± spreading in fruit, with margin ciliate or ciliolate, scarious, often with submarginal red zone; midrib obscure or indistinct, veins not prominent; laminar glands linear, numerous. *Petals* bright yellow, not tinged red, spreading or ± incurved, 21–30 × 15–20 mm, *c.* 3 × sepals, obovate, with apiculus subterminal to lateral, rounded; margin entire or ciliate, with few inframarginal gland dots. *Stamen fascicles* each with *c.* 50–70 stamens, longest 12–18 long, *c.* 0·5–0·75 × petals; anthers reddish. *Ovary* 6·5–9 × 5–6 mm, ovoid to ovoid-conic; styles 8–11 mm long, 1–1·5 × ovary, erect, outcurved at apex; stigmas not capitate. *Capsule* 9–12 × 9–11 mm, broadly ovoid. *Seeds* dark brown, 0·9–1·1 mm long, ± cylindric, not or scarcely carinate, shallowly scalariform-reticulate. 2n = 36 (Sugiura, 1936), *c.* 50 (Gibby in Robson, 1981).



Known only in cultivation.

CULTIVATED. Specimens seen from England, Scotland, Ireland, France, the Netherlands, Germany, U.S.A. (Massachusetts, California).

H. x *moserianum* is the result of an artificial cross (*H. patulum* ♀ x *H. calycinum* ♂) made in *c.* 1887 at Moser's nursery at Versailles. It has the general habit of a low *H. patulum* (with low spreading branches); but the influence of *H. calycinum* is apparent in the subcoriaceous leaves with marked reticulate venation (visible beneath), the relatively large flowers with more spreading petals, the reddish anthers and the relatively long stamens and styles. It is partially fertile; the capsules contain a mixture of fully developed seed and flattened or shrivelled seed. From some developed seeds my wife raised a varied batch of seedlings, some of which have flowered and seem healthy. These plants show the re-assortment of characters that one would expect from F_1 hybrid seed.

The reported chromosome numbers of *H.* x *moserianum* (2n = 36 and *c.* 50) are difficult to reconcile with its known parentage. *H. patulum* (2n = 36) x *H. calycinum* (2n = 20) should give 2n = 28. Even if the record of 2n = 36 for *H. patulum* is based on a misidentification and that species in fact has 2n = 20 like *H. uralum*, the number should be 2n = 20. Only further research will resolve this apparent anomaly. If the cross was between 2n = 36 (unreduced) and n = 10, giving 3n = 46, that triploid number would not be consistent with the partial fertility of *H.* x *moserianum*.

A variegated form of the hybrid, in which the red sap tinges some of the white parts pink, arose spontaneously in 1894, a short time after the original cross was made. It has smaller leaves and flowers than the typical form and, although not vigorous in growth, is now widely used as a foliage plant.

31xa(42xa). **H. x moserianum** 'Tricolor'

Hillier's man. trees & shrubs: 152 (1971); *Bean, trees & Shrubs hardy in Br. Isles* 8th ed. **2**: 420 (1973).

H. x *moserianum* var. *tricolor* Maumené in *Le Jardin* **8**: 186, f. 93 (1894); Plaisted & Lighty in *Nat. Hort. Mag.* **38**: 125 (1958). Type: cult. France, Orleans, 79 route d'Olivet, *Chenault* (specimen ?).
H. moserianum forma *tricolor* (Maumené) Rehder, *Bibl. cult. trees & shrubs*: 463 (1949); Thomas in *Gdnrs' Chron.* III, **147**: 227 (1960).
H. x *moserianum* nothomorph *tricolor* (Maumené) N. Robson in *Bull. Br. Mus. nat. Hist.* (Bot.) **8**: 170 (1981).

Icon: Maumené in *Le Jardin* **8**: 187, f. 93 (1894).

Leaves variegated with pink and white, narrowly lanceolate. *Flowers c.* 20–30 mm in diam., deeply cyathiform, sterile.

CULTIVATED. Specimens (live) seen from England (1984).

32(43). **Hypericum uralum** Buch.-Ham. ex D. Don

in *Curtis's bot. Mag.* **50**: t. 2375 (1823), *Prodr. Fl. Nepal.*: 218 (1825); Schilling in *J. Roy. Hort. Soc.* **94**: 224 (1969); Anon. in *Bull. Dept. Med. Pl. Nepal* **3**: 117 (1970); N. Robson in *J. Roy. Hort. Soc.* **95**: 491, f. 423 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 152 (1971); Murata in *Acta Phytotax. Geobot.* **25**: 111 (1973); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 421 (1973); N. Robson in Nasir & Ali, *Fl. W. Pakistan* **32**: 7 (1973), in Hara & Williams, *Enum. fl. pl. Nepal* **2**: 62 (1979). Type: Nepal, Narainhetty, *Hamilton* (BM!, lectotype), see p. 000.
H. patulum var. *attenuatum* Choisy in DC., *Prodr. syst. nat. veg.* **1**: 545 (1824); Kuntze, *Rev. gen. pl.* **1**: 60 (1891) sub subsp. *normale* Kuntze; Gagnepain, *Fl. gen. Indo-chine* suppl. **1**: 249 (1943) pro parte quoad typum. Type: Nepal, Sheopore, 1821, *Wallich* 4809A (G-DC!, holotype BM!, E!, FI!, K-Wall!, L!, SING!).
H. patulum sensu Wallich, *Numer. list*: No. 4809 (1831); Dyer in Hook. f., *Fl. Brit. Ind.* **1**: 254 (1874); Burkill in *Rec. botl Surv. Ind.* **4**: 99 (1910); Parker, *For. fl. Punjab, Hazara & Delhi,* ed. 2: 29 (1924); Banerji in *J. Bombay Nat. Hist. Soc.* **51**: 774 (1953), **55**: 251 (1958), in *Rec. botl Surv. Ind.* **19** (2): 27 (1966); non Thunb. ex Murray (1774).
Norysca urala (Buch.-Ham. ex D. Don) K. Koch, *Hort. dendrol.*: 66 (1853); Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 102 (1951), in Kihara, *Fauna & fl. Nepal Himal.*: 180 (1955), in Hara, *Fl. eastern Himal.*: 210 (1966), in *Bull. Dept. Med. Pl. Nepal.* **2**: 11 (1969), in Hara, *Fl. eastern Himal.* **2**: 82 (1971).
H. nepalense K. Koch, *Dendrol.* **1**: 497 (1869), in synon., non *H. napaulense* Choisy (1824).
H. ramosissimum K. Koch, *Dendrol.* **1**: 497 (1869), in synon., non Ledeb. (1842).
H. uralense Lavallée, *Arb. segrez.*: 25 (1877), sphalm.
H. patulum var. *uralum* (Buch.-Ham. ex D. Don) Koehne, *Deutsche Dendrol.*: 415 (1893); Rehder, *Man. Cult. Trees & Shrubs.,* ed. 2: 638 (1940).
Norysca urala var. *angustifolia* Y. Kimura in Hara, *Fl. eastern Himal.*: 210 (1966) pro parte excl. typum.
H. hookerianum 'Buttercup' hort.

Icon: D. Don in *Curtis's bot. Mag.* **50**: t. 2375 (1823).

Shrub, 0·3–2 m tall, bushy, with stems erect, arching, often frondose. *Stems* red, 4-lined or 4-angled and strongly ancipitous when young, eventually 2-lined or terete; internodes 5–20 m long, shorter than leaves; bark reddish-brown. *Leaves* petiolate, with flat petiole 0·5–1 mm long; lamina 10–40 × 4–24 mm, all lanceolate or older ones ovate, acute to rounded-apiculate, margin plane, base narrowly to rarely broadly cuneate, ± densely glaucous beneath, chartaceous; venation: 3 pairs main laterals, with midrib branches and tertiary reticulum scarcely visible; laminar glands streaks (towards midrib) and dots; ventral glands usually ± dense. *Inflorescence* 1–3(–10)-flowered, from 1–2 nodes, subcorymbiform, if from 2 nodes then with short

apical internode, often with 1–3-flowered branches from middle of stem; pedicels 3–7 mm long; bracts narrowly oblong, deciduous. *Flowers* 15–30 mm in diam., ± deeply cyathiform; buds broadly ovoid to globose, obtuse to rounded. *Sepals* 3·5–6(9) × (1)2–5(6·5) mm, free, imbricate, subequal or unequal, erect in bud and fruit, oblong or elliptic to obovate-spathulate, rounded or very rarely obtuse, with margin entire, narrowly hyaline; midrib not or scarcely distinct, veins not or rarely slightly prominent; laminar glands linear, numerous. *Petals* golden to deep yellow, not tinged red, incurved, 9–18 × 5–12 mm, 2·5–3 × sepals, broadly obovate to subcircular, with apiculus lateral to subterminal, rounded to obscure; margin entire, without inframarginal gland dots. *Stamen fascicles* each with 40–60 stamens, longest 4–6(8) mm long, 0·25–0·5 × petals; anthers golden to deep yellow. *Ovary* 3–5 × 2·5–3 mm, broadly ovoid to globose; styles 2·5–4·5 mm long, 0·6–0·9(1) × ovary, erect and ± divergent near apex or wholly outcurving; stigmas narrowly capitate. *Capsule* 7–11(13) × 7–11 mm, subglobose (or more rarely broadly ovoid) to globose. *Seeds* dark brown, 0·4–0·6 mm long, cylindric-ellipsoid, scarcely carinate, shallowly linear-foveolate. 2n = 20.

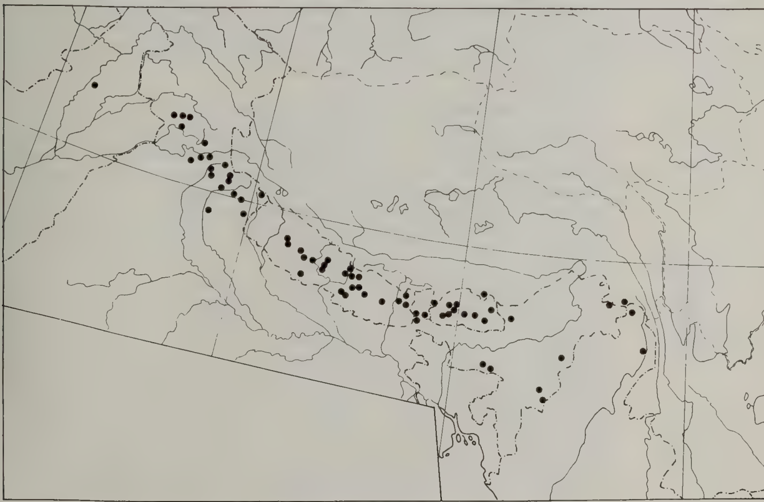
In dry, open habitats (grassy or rocky slopes, open woodland, pastures, cliff edges), and sometimes in thickets and by streams; 1500–3600 m.

China (Xizang [Tibet]), Burma (Kachin, Chin), India (Manipur, Mizoram?, Nagaland, Meghalaya), Bhutan and Himalaya west to Pakistan (Sarghoda). Maps 23, 24.

CHINA. Xizang [Tibet]: Senge Dzong, near Tawang, 2700 m, 14.xi.1913, *Bailey* 12 (E); Rima, 1500 m, 11.viii.1950, *Kingdon Ward* 20121 (BM).

BURMA. Kachin: Bhamo, 30.ix.1908, *Cubitt* s.n., (E); Adung Valley, vicinity of Tahawndam, ii.xi.1931, *Kingdon Ward* 10153 (BM). Chin: Mt. Victoria, Old Kanpelet, 20.v.1924, *Cooper* 5922A (E, SING).

INDIA. Manipur: Khongui [Imphal], N.E. ranges, 1800 m, *Watt* 6328 (E, K). Nagaland: Naga Hills, Khiyakhu, 1800 m, *Bor.* 5084 (K). Meghalaya: Khasi Hills, Shillong, 1500–1800 m, 12.vii.1949, *Kingdon Ward* 18641 (BM). Arunachal Pradesh: Delei valley, 1500 m, 12.vii.1928, *Kingdon Ward* 8444 (K). West Bengal: Labah [Kalimpong], 2100 m, ix.1904, *Haines* BB 983 (E, K). Uttar Pradesh: Mussoorie,



Map 24 Sect. 3. *Ascyreia*: 32. *H. uralum* ● (see also Map 23).

Landour, 1950 m, i.xii.1936, *R. R. Stewart* 15777 (A). Himachal Pradesh: Simla, Bushahr, Manjoli, 4.vii.1934. *Parmanand* 354 (E). Kashmir: Basaoli, 1650 m, 26.ix.1876, *Clarke* 31592 (K).

PAKISTAN. Sargodha: Shahpur, Mt. Sakesar, 1500 m, 4.iv.1902, *Drummond* 13806 (K).

NEPAL. West: Dhaulakot, 2100 m, 17.viii.1952, *Polunin, Sykes & Williams* 464 (BM, E). Central: Annapurna Himal, Sati Khola, 2250 m, 5.viii.1954, *Stainton, Sykes & Williams* 6706 (BM, E). East: Batasay to Halhale Bhanjang, 1.xii.1963, *Hara et al.* T. 6304584 (BM, TI).

SIKKIM. Toong, 1800 m, 6.vii.1909, *Smith & Cave* 879 (A).

BHUTAN. Gyasa Dzong, Mo Chu, 3330 m, 3.vii.1949, *Ludlow & Sherriff* 17400 (BM); Tobrang (Trashiyangse Chu), 2100 m, 6.vii.1949, *Ludlow & Sherriff* 20493 (BM, E).

CULTIVATED. Specimens seen from England (1834–1983), Scotland (1964), Eire (1967), and Germany (1886).

H. uralum is closely related to (and apparently derived from) *H. henryi* subsp. *uraloides*; some of the specimens from Khasiya approach the latter in morphology rather closely. Indeed, it is difficult to describe good characters to separate these taxa, although they seem quite distinct in cultivation. However, the presence of frondose branching (i.e. with lateral branches in one plane) in *H. uralum*, in combination with the usually broader leaves and sepals, will usually suffice to distinguish it from *H. henryi* subsp. *uraloides*.

In *Flora of West Pakistan* (Robson, 1973), I cited *Curtis's bot. Mag.*: t. 2375 (1823) as the type of *H. uralum*, as the cultivated plant from which the illustration was made was apparently not preserved. It was grown from Nepal seed (probably sent by Wallich in 1818–21) by Whitby, Brame & Milne at their Fulham Nursery, London, and flowered in 1822. It is clear, however, that Don obtained at least the epithet *uralum* from Hamilton's notes; and in the introduction to *Prodromus florae nepalensis* (Don, 1825) he claims to have seen all Hamilton's Nepal specimens, collected in 1802–3. The Hamilton specimen of *H. uralum* in BM must, therefore, have some type status. Don's description in *Curtis's bot. Mag.* was probably derived initially from the Nepal specimen and confirmed or modified after he had seen the cultivated plant, so that specimen and illustration should be regarded as syntypes. As a specimen is always to be preferred to an illustration when choosing lectotypes, I have selected the Hamilton specimen as lectotype of *H. uralum*.

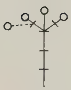
33(44). **Hypericum maclarenii** N. Robson, **sp. nov.**

H. choisiano Wallich ex. N. Robson affinis, sed foliis petiolo breviora lamina angustiora subtus glauca haud reticulata, alabrastris apiculatis, sepalis haud foliosis, excurvatis vel patulis, petalis obovato-oblanceolatis patulis, staminibus longioribus, ovario ovoideo-conico stylis aequantibus vel paulo brevioribus, differt. Type: China, Sichuan, Tatsienlu [Kangding], 1938, *McLaren's Collectors* AD151 (E!, holotype).

H. stellatum sensu N. Robson in *J. Roy. Hort. Soc.* **95**: 493 (1970) pro parte.

Icon: —.

Shrub 0·75–1 mm tall, with branches erect. *Stems* red, shallowly 4-lined and sometimes ancipitous when young, soon terete; internodes 10–25 mm long, usually shorter than leaves; bark reddish-brown. *Leaves* petiolate, with petiole 0·5–2 mm long; lamina 25–40 × 7–10 mm, narrowly lanceolate, acute to subacute, margin plane, base cuneate, ± densely glaucous beneath, chartaceous; venation: 3–4 pairs main laterals, branched, the lower sometimes free, the midrib pinnately branched, all branches clearly visible and forming undulating inframarginal vein, with tertiary reticulum almost invisible; laminar glands long (in lower leaves) to short streaks and dots; ventral glands ± sparse. *Inflorescence* 1–4-flowered, from terminal node, subcorymbiform; pedicels 7–10 mm long; bracts reduced, linear-lanceolate, persistent ? *Flowers* 40–50 mm in diam., stellate; buds narrowly ovoid, apiculate. *Sepals* 7–11 × 2·5–5 mm, free, open, subequal to unequal, ± outcurved in bud, spreading in fruit, narrowly elliptic, acute to acuminate, with margin entire; midrib clearly visible,



veins not prominent; laminar glands linear or ± interrupted, *c.* 12–14. *Petals* golden yellow, sometimes tinged red dorsally, spreading, 20–25 × 12–15 mm, 2·5–3 × sepals, obovate-oblanceolate, with apiculus acute to obtuse, lateral, margin entire, eglandular. *Stamen fascicles* each with *c.* 50 stamens, longest 13–15 mm long, *c.* 0·6 × petals; anthers golden yellow. *Ovary* 7–8 × 3·5–5 mm, ovoid-conic; styles 6–8 mm long, 0·85–1 × ovary, free, outcurved near apex; stigmas narrowly capitate. *Capsule* 12–15 × 7–8 mm, narrowly ovoid. *Seeds* dark brown, 1–1·5 mm long, cylindric, carinate, shallowly linear-reticulate to linear-foveolate. 2n = ?

Steep rocky banks; *c.* 2000 m.

China (W. Sichuan). Map 26.

CHINA. Sichuan: Tatsienlu [Kangding], 1923. *Cunningham* 171 (E), 1924, *Cunningham* 530 (E); Luding–Kangding road, Kangding Ho gorge, *c.* 2000 m, 12.ix.1981, *Lancaster* L. 863 (BM).

CULTIVATED. Specimens seen from England (1983–ex *Lancaster* L. 863).

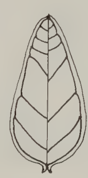
H. maclarenii, like *H. subsessile*, is an isolated relict species, having been collected only in the vicinity of Kangding. It has affinities with three groups of species, being closest to *H. choisianum* and *H. bellum* but also showing similarities to *H. subsessile* and even to the *H. kouytchense – H. stellatum* group. From *H. choisianum* and *H. bellum* sens. lat. it differs by its erect, not foliaceous sepals, narrower, spreading petals and longer stamens and styles; from *H. subsessile* it differs by its subterete stems, petiolate, lanceolate, ± glaucous leaves and the floral characters already mentioned; and from the *H. kouytchense* group by the lateral petal apiculus, shorter styles and leaves glaucous beneath with markedly 'looped' venation and (in the lower ones) striiform glands.

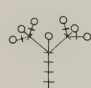
34(45). **Hypericum choisianum** Wallich ex N. Robson

in Nasir & Ali, *Fl. W. Pakistan* **32**: 6, f. 1 E–H (1973); in Hara & Williams, *Enum. fl. pl. Nepal* **2**: 61 (1979). Type: India, Kumaon, *R. Blinkworth* in *Wallich* 4805 (K-Wall.!, holotype).

H. choisianum Wallich, *Numer. list*: No. 4805 (1831), nomen.
H. oblongifolium sensu Wallich, *Numer. list*: No. 4810 (1831), non Choisy (1821).
H. hookerianum var. *leschenaultii* sensu Dyer in Hook. f., *Fl. Brit. Ind.* **1**: 254 (1874); Banerji in *J. Bombay nat. Hist. Soc.* **51**: 774 (1953); non *H. leschenaultii* Choisy (1824).
Norysca hookeriana var. *leschenaultii* sensu Y. Kimura in Hara, *Fl. eastern Himal.*: 210 (1966), non *H. leschenaultii* Choisy (1824).

Icon: N. Robson in Nasir & Ali, *Fl. W. Pakistan* **31**: 5, f. 1E–H (1973).





Shrub (0·1)–2 m tall, bushy, with branches erect to ascending. *Stems* red to orange, 4-lined and ancipitous when young, eventually terete; internodes 15–55 mm long, usually shorter than leaves; bark grey-brown. *Leaves* petiolate, with petiole 2–4 mm long; lamina 25–88 × 10–42 mm, triangular–lanceolate or rarely triangular-ovate to ovate, acute or acuminate to obtuse or rarely rounded, margin plane, base broadly cuneate to rounded or subcordate, paler beneath, not glaucous, chartaceous; venation: 3–5 pairs main laterals, branched, the lower pairs sometimes free, the midrib branches impressed, with tertiary reticulum almost invisible to marked and rather dense; laminar glands streaks and dots; ventral glands absent. *Inflorescence* 1–7-flowered, from terminal node, subcorymbiform; pedicels 3·5–11 mm long; bracts foliar to narrowly elliptic, persistent. *Flowers* 40–70 mm in diam., shallowly to deeply cyathiform; buds ovoid, sharply acute to obtuse. *Sepals* 7–18 (or longer if markedly foliaceous) × 2–10 mm, free, imbricate or open, unequal, spreading to recurved in bud and fruit, narrowly to very broadly elliptic, acute to apiculate or more rarely obtuse, with margin entire; midrib clearly visible, veins not usually prominent; laminar glands linear, interrupted towards apex, numerous. *Petals* deep golden yellow, sometimes tinged red dorsally, slightly to markedly incurved, 16–30 × 15–22 mm, 1·7–2·2 × sepals, broadly obovate to obovate-circular, with apiculus subterminal, rounded, margin entire, eglandular. *Stamen fascicles* each with 60–80

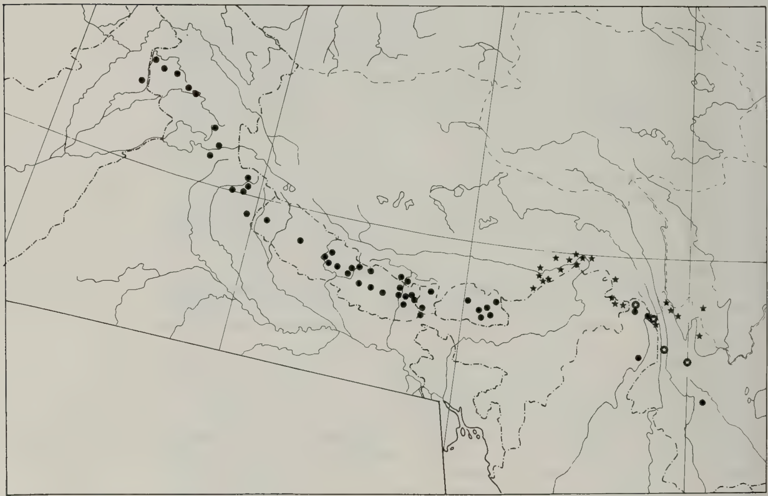
stamens, longest 6–10 mm long, 0·35–0·4 × petals; anthers golden yellow. *Ovary* (5)6–8(9) × 3·5–5·5 mm, ± broadly ovoid; styles 3–5 mm long, 0·35–0·7 × ovary, free, outcurved near apex; stigmas narrowly capitate. *Capsule* (9–)14–19 × 8–12 mm, ovoid-conic to subglobose. *Seeds* dark brown, 0·7–1 mm long, cylindric to cylindric-ellipsoid, carinate or shallowly winged, shallowly linear-reticulate to linear-foveolate. 2n = ?

Dry to moist, open to half-shaded situations (grassy or rocky slopes or cliffs, in thickets or in *Rhododendron* forest); 1600–4800 (Tibet), mainly 2400–4200 m.

China (Yunnan, S. Xizang), Burma (north), Bhutan, Sikkim, Nepal, India (W. Bengal, Kumaun to Kashmir), Pakistan (Hazara). Map 25.

CHINA. Yunnan: Jing-dong, Feng-Guan-Shan, 1600 m, 29.iv.1940, *Li* 3458 (IBSC); Taron-Taru Divide, Barcuwhang, 3.ix.1938, *Yü* 20107 (E). Xizang (Tibet): Yatung [Yathang], 1897, *Hobson* (K); Karma valley, 3150 m, 25.vi.1922, *Mt. Everest Exped.* (K); Niangdam La, Kharta, 4800 m, 2.vi.1922, *Mt. Everest Exped.* (K).

BURMA. Kachin: Upper Adung Valley, N. of Tahawndam, 3000–3300 m, 22.x.1931, *Kingdon Ward* 10133 (BM).



Map 25 Sect. 3. *Ascyreia*: 34. *H. choisianum* ●, 35a. *H. bellum* subsp. *latisepalum* ✪, 35b. *H. bellum* subsp. *bellum* ★.

BHUTAN. Rathong Chu, 3900 m, 1913, *Ribu & Rhomo* 6545 (E); Sinchu La, Timpu, 2700 m, 10.viii.1914, *Cooper* 3373 pp. (E); Dongla Lingtsi and Trashiyangtsi, 3300 m, 10.viii.1915, *Cooper* 4398 (BM, E); Lao, Me La Chu, 2700 m, 5.vii.1949, *Ludlow, Sherriff & Hicks* 20822 (BM); below Sengor, *c.* 3000 m, 6.vii.1979, *Grierson & Long* 2540 (BM, E).

SIKKIM. Tonglo, 3000 m, vii.1882, *Gamble* 10414 (FI, K); Singalilah pass, 3300 m, i.1848, *Hooker* 103 (K).

NEPAL. East: Lumding Khola, 2850 m, 13.vii.1974, *McCosh* 399 (BM, E). Central: Lamjung Himal, 3450 m, 16.vii.1954, *Stainton, Sykes & Williams* 6372 (BM). West: above Ranmagaon, 3300 m, 2.vii.1954, *Stainton, Sykes & Williams* 3348 (BM).

INDIA. W. Bengal: Darjeeling between Ghum and Lopchu, 2100 m, 19.vi.1960, *Kanai, Murata & Togashi* (K). Uttar Pradesh: Kumaun, Younrani, 2100 m, 24.vi.1948, *Chand* 790 (L); N. Gharwal, Nandargiri Valley, 2850 m, 12.vi.19, *Osmaston* 1062 (A). Himachal Pradesh: Bashahr, between Khadrala and Baghi, 2700 m, 19.vi.1928, *Parker* 3057 (K); Kulu, versus transitum Jalauri, 2850 m, 27.vii.188, *Drummond* 8427 (E, K). Kashmir: Kishtawar Distr., Bangar, 3600 m, 31.vii.1943, *Ludlow & Sherriff* 9254 (BM).

PAKISTAN. Azad Kashmir: Poonch [Punch] to Bantara Gali, 2400 m, 4.vii.1952, *Stewart & Nasir* 24097 (BM, RAW). Hazara: Nandi, Kund, *Anon.* (RAW).

CULTIVATED. Specimens seen from England (1972–1983) and Ireland (1980).

H. choisianum has sometimes been confused with the Indonesian *H. leschenaultii*, on account of the narrow sepals that occur in both species; but it differs from that species particularly in the ovary and capsule, which are ovoid-conic to subglobose (not narrowly conic), but also in its relatively longer stamens and styles, broader ovary and capsule, longer petiole and frequently more densely reticulate leaf venation. *H. choisianum* seems to be a derivative of 33. *H. maclarenii*, whereas 22. *H. leschenaultii* is derived from 21. *H. siamense* in a somewhat parallel way.

H. choisianum can also be very similar to 28. *H. hookerianum*, which grows in a lower but overlapping zone of the central and eastern Himalaya; but the erect, rounded, never foliaceous sepals, relatively shorter stamens and styles, and bluish leaves without reticulate venation of the latter usually serves to distinguish it.

In Nepal, *H. choisianum* takes on a rather distinct facies in which the typical form (leaves with venation ± obscurely reticulate, flowers solitary or rarely 2–3, sepals ovate to lanceolate) is replaced by one in which the leaves always have markedly reticulate venation and the flowers are usually in cymes of 3–7 with narrowly lanceolate to narrowly elliptic sepals. Although this form is easily recognisable, it is connected by too many intermediates with the typical one to allow it taxonomic recognition.

The Chinese and Burmese plants, from isolated localities divorced from the main Himalayan range of the species, are nearest to *H. bellum*; and the one from furthest east (*Li* 3458) is unusual in having almost elliptic leaves with a rounded apex.

35(46). **Hypericum bellum** H. L. Li

in *J. Arnold Arbor.* **25**: 308 (1944); Robson in *J. Roy. Hort. Soc.* **95**: 491, f. 239 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 150 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 408 cum fig. (1973). Type: China, Yunnan, Kiukiang Valley (Taron), Mt. Chingtinglaka, 28.vii.1938, *Yü* 19497 (A!, holotype; E!).

Shrub 0·3–1·5 m tall, often forming low thickets, with branches dense, erect or arching. *Stem* red to orange, 4-angled and slightly ancipitous at first, very soon terete; internodes 10–80 mm long, usually equalling or exceeding leaves; bark grey-brown. *Leaves* petiolate, with petiole 0·5–3 mm long; lamina 15–65(–78) × 7–46 mm, lanceolate-oblong or ovate-oblong to broadly rhombic-ovate or subcircular, obtuse to rounded or emarginate, often apiculate, margin plane or undulate, base ± broadly cuneate or rounded to truncate or subcordate, paler or glaucous beneath, chartaceous; venation: 3–4 pairs main laterals (the upper not distinctly intramarginal), with midrib obscurely branched distally with or apparently without ± clear lax tertiary reticulum; laminar glands dots and short streaks, ventral glands absent or ± dense. *Inflorescence* 1–7-flowered, from apical node, subcorymbiform, rarely with flowering branches from lower nodes; pedicels 3–14 mm long (–30 mm in fruit); bracts foliar to narrowly elliptic, persistent to deciduous. *Flowers* (25–)30–50(–60) mm in diam., cyathiform; buds broadly ovoid, obtuse to rounded. *Sepals* 3–12 × 2·5–8 mm, sometimes enlarging in fruit, free, imbricate, subequal, erect in bud and fruit, broadly elliptic or subcircular to broadly or narrowly oblong, acute or obtuse to apiculate or rounded, with margin entire or finely eroded-denticulate towards apex and often scarious; midrib rarely conspicuous, veins not prominent;

laminar glands linear, *c.* 12. *Petals* golden yellow to butter-yellow or rarely pale yellow, not red-tinged, incurved, 15–30 × 11–25 mm, 3–5 × sepals, broadly to narrowly obovate, with apiculus subterminal, rounded, margin entire. *Stamen fascicles* each with 25–65 stamens, longest 6–15 mm long, 0·35–0·6 × petals; anthers deep golden yellow. Ovary 4–8 × 3–7 mm, narrowly ovoid to subglobose; styles 3–8 mm long, 0·6–1 × ovary, free, suberect to divergent, outcurved near apex; stigmas small. *Capsule* 10–15 × 6–15 mm, narrowly to broadly ovoid, often puckered. *Seeds* dark reddish-brown, 0·8–1 mm long, narrowly cylindric, ± carinate, shallowly scalariform-reticulate. 2n = ?

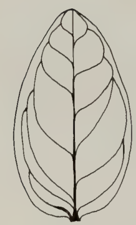
Scrub or forest margin, open dry grassy slopes, sometimes by streams or in cultivated ground; (1440)1800–3900 m.

China (W. and NW. Yunnan, S.W. Sichuan, S.E. Xizang [Tibet]), N. Burma, India (Arunachal Pradesh). Map 25.

H. bellum, like *H. choisianum*, is related to the relict *H. maclarenii* and differs from it in its cyathiform flowers with broader petals and broader leaves. From *H. choisianum* it can be distinguished by its oblong to ovate leaves that are usually broader and never acute; and the forms of these species that approach one another in leaf shape differ in style and stamen length and in sepal aspect.

The more primitive subspecies of *H. bellum* (subsp. *latisepalum*, which approaches *H. choisianum*) has longer, broadly elliptic sepals, which are often foliose but nearly always acute or obtuse to apiculate, the styles and stamens are longer, and the leaves vary from narrowly oblong to broadly ovate. It has a dissected distribution and shows a morphological trend westwards from W. Yunnan to N. Burma, where its variation and range almost merge with those of the type subspecies.

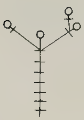
Subsp. *bellum* occurs in NE. India and on the north side of the Himalayan range from southern Xizang to SW. Sichuan and NW. Yunnan. Its sepals are subcircular to narrowly oblong but always rounded, the styles and stamens are usually shorter, and the leaves vary from oblong-ovate through broadly ovate to broadly rhombic or subcircular. Some specimens from the east of its range approach the Chinese rather than the Burmese form of subsp. *latisepalum*, which suggests that subsp. *bellum* may prove to be diphyletic. In that case, the epithet would apply to the Chinese form and the Tibetan one would be rendered nameless. The latter has an undulate leaf margin and is probably the only form of subsp. *bellum* cultivated now in Europe.



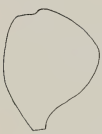
35a(46a). **Hypericum bellum** subsp. **latisepalum** N. Robson, **subsp. nov.**

a subsp. *bellum* foliis pro ratione angustioribus margine semper planis, sepalis longioribus latioribus, acutis vel obtusis vel apiculatis, petalis ovariisque maioribus, staminibus stylisque longioribus, differt. Type: China, Yunnan, Tali [Dali], top of Yin Yo Mtn, viii.1932?, *McLaren's Colls*, 214C (BM!, holotype; E!, isotype).

Icon: —.



Leaves with petiole 1·5–3 mm long; lamina (30–)37–87 × (13)16–46 mm, narrowly oblong or lanceolate-oblong to ovate-oblong (l: b usually = 2 or more). *Flowers* 40–60 mm in diam., buds acute to obtuse. *Sepals* 8–13 × (5)6–8 mm, broadly elliptic, acute to obtuse or apiculate, entire. *Petals* 23–37 × 18–30 mm. *Stamens fascicles* with longest stamen (10)14–21 mm long, (0·5)0·6–7 × petals. *Ovary* 7–8 × 6–7 mm, broadly ovoid; styles 6–7 mm long; 0·75–1·1 × ovary. *Capsule* 12–15 × 10–15 mm, broadly ovoid.



China (western Yunnan, northern Burma). Map 25.

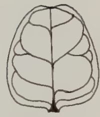
CHINA. Yunnan: Cangshan, above Yangbi, Shanchang, 2700 m, 9.v.1981, *Sino-Brit. Exp. Cangshan* 421 (BM, E); Salwin-Kiukiang Divide, Panbahlung, 2500 m, 22.x.1938, *Yü* 20827 (KUN).

BURMA. Kachin: Nam Tamai valley (Adung Wang to Gamlang Wang), 3000–3300 m, 2.x.1937, *Kingdon-Ward* 13350 (BM).

CULTIVATED. Specimens of *Sino-British Expedition to Cangshan* (421, 550, 693) seen from England (1983).

35b(46b). **Hypericum bellum** subsp. **bellum**

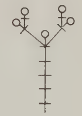
Icon: Robson in *J. Roy. Hort. Soc.* **95**: f. 239 (1970).



Leaves with petiole 0·5–2·5 mm, long; lamina 15–65 × 7–43 mm, ovate-oblong or broadly rhombic to subcircular (l: b = 2 or less). *Flowers* 25–35 mm in diam.; buds obtuse to rounded. *Sepals* 3–9 × 2·5–6 mm, narrowly elliptic to obovate, rounded or rarely subapiculate, entire or finely eroded-denticulate. *Petals* 15–25(–30) × 11–21(–21) mm. *Stamen fascicles* with longest stamen 6–10(–11) mm long, 0·35–0·4(–0·6) × petals. *Ovary* 4–6 × 3–3·5 mm, broadly to narrowly ovoid; styles 3–6 mm long, 0·6–1 × ovary. *Capsule* 10–15 × 6–10 mm, broadly to narrowly ovoid.

China (NW. Yunnan, SW. Sichuan, SE. Xizang), India (Arunachal Pradesh). Map 25.

CHINA. Yunnan: Atuntze [Tehtsin], Dokerla, 2800–3000 m, 1.xi.1937, *Yü* 7823 (BM, E); Chungtien, Haba, 2600 m, 22.xi.1937, *Yü* 14939 (BM, E). Sichuan: Pao-hsing-hsien [Mupin], 22.vii.1936, *Chu* 3213 (BM, E, K); Mao Hsien, vii.1930, *Wang* 21846 (KUN). Xizang [Tibet]: Rong Tö valley, above Migu, Zayul, 3000–3300 m, 28.xi.1933, *Kingdon Ward* 11024 (BM); Kongbo, Chema Dzong, Pasum Chi, 3300 m, 17.ix.1947, *Ludlow, Sherriff & Elliott* L. & S. 15737 (BM, E); Qagan, 2650 m, 2.vii.1973, *Qing* 73–54 (KUN).



INDIA. Arunachal Pradesh; Walong, 2400–2700 m, 28.ix.1950, *Kingdon Ward* 22018 (BM).

CULTIVATED. Specimens seen from England (via France, probably ex *Monbeig* (1912–1919), and ex *Ludlow, Sherriff & Elliot* 15737 (1952–1983)).

H. bellum subsp. *bellum* was first introduced into Europe from Yunnan by the French Jesuit missionary Pierre Monbeig, and Otto Stapf of Kew named it *H. monbeigii* in the late 1920s. This name, however, was never published. Recent European cultivated material originated from later introductions from Tibet by Ludlow & Sherriff.

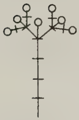
36(47). **Hypericum kouytchense** H. Léveillé

in *Bull. Soc. Agric. Sci. Arts Sarthe* **39**: 322 (1904), in *Bull. Soc. bot. Fr.* **54**: 592 (1908), in *Reprium nov. Spec. Regni veg.* **6**: 375 (1909) [reprint of 1904 paper]; Lauener in *Notes Roy. Bot. Gard. Edinb.* **27**: 3 (1966); N. Robson in *J. Roy. Hort. Soc.* **95**: 490, ff. 240, 241 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 151 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed., **2**: 417 (1973). Type: China, Guizhou, mont de Lou-tsang-koan [Lou shan Guan], 31.v.1897, *Bodinier* 1603 (E!, holotype; A!, isotype).

H. patulum sensu H. Léveillé in *Bull. Soc. bot. Fr.* **54**: 591 (1908) pro parte, quoad specim, *Bodinier* 2662, non Thunb. ex Murray (1784).
H. ascyron sensu H. Léveillé, *Fl. Kouy-Tchéou*: 198 (1914), non L. (1753).
H. longifolium sensu H. Léveillé, *Fl. Kouy-Tchéou*: 199 (1914) pro parte, quoad *Bodinier* 1774, non H. Léveillé. (1904).
Norysca kouytchensis (H. Léveillé) Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 98 (1951) ('*koutchense*').
H. penduliflorum hort. – Plaisted & Lighty in *Nat. Hort. Mag.* **38**: 125, 128 (t.) (1959); Thomas in *Gdnrs' Chron.* III, **147**: 255 cum fig. (1960); nomen.
H. patulum var. *grandiflorum* hort. – Thomas in *Gdnrs' Chron.* III, **147**: 226 (1960), nomen.
H. grandiflorum sensu hort. pro parte, non Salisb. (1798).
H. patulum 'Sungold', hort. amer.
H. patulum 'Laplace' (Boom *c.* 1934).
H. patulum 'Summergold' (Boom *c.* 1956).

Icon: N. Robson in *J. Roy. Hort. Soc.* **95**: ff. 240, 241 (1970).

Shrub 1–1·8 m tall, with branches arched or pendulous. *Stems* red, 4-lined when young, becoming 2-lined, eventually terete; internodes 10–40 mm long, shorter than to exceeding leaves; bark reddish-brown. *Leaves* petiolate, with petiole 0·5–1·5 mm



long; lamina 20–58 × 6–30 mm, elliptic or lanceolate to ovate or triangular-ovate, acute to obtuse or rarely rounded-apiculate, margin plane, base cuneate or subangustate to rounded, paler beneath, not to scarcely glaucous, chartaceous; venation: 3–4(5) pairs main laterals, with midrib branched distally, without or with obscure tertiary reticulum; laminar glands dots and short streaks, ventral glands ± dense. *Inflorescence* 1–7(–11)-flowered, from 1(2) node(s), subcorymbiform; pedicels 5–10 mm long; bracts intermediate to narrowly lanceolate, deciduous. *Flowers* 40–65 mm in diam., stellate; buds narrowly ovoid, acute to subacuminate. *Sepals* 7–15 × 2·5–7 mm, free, imbricate, equal, ± spreading in bud and fruit ± narrowly ovate to lanceolate, acute to acutely acuminate, with margin entire; midrib conspicuous, veins not prominent; laminar glands linear, *c.* 10–11. *Petals* bright golden yellow, not tinged red, spreading or recurved, 24–40 × 16–25 mm, *c.* 3 ± sepals, obovate-oblong to obovate, with apiculus subterminal, acute; margin minutely glandular-denticulate towards apex. *Stamen fascicles* each with 35–50 stamens, longest 18–29 mm long, 0·65–0·8 × petals; anthers golden yellow. *Ovary* 6–8 × 4–6 mm, ovoid-pyramidal to narrowly ovoid; styles 8–10 mm long, *c.* 1·2–1·35 × ovary, free, erect, slightly outcurved at apex; stigmas small. *Capsule* 17–20 × 8–10 mm, ± narrowly ovoid-pyramidal to ovoid, red when immature. *Seeds* dark purplish-brown, 2–3·2 mm long, narrowly cylindric, narrowly winged, almost smooth. 2n = 36, 40 (also 20?, see below).

Pastures, hillsides, streamsides, among rocks; *c.* 1500–2000 m.

China (Guizhou). Map 26.

CHINA. Guizhou: Kouy-yang [Guiyang], mont à Kien Lin chan Hem, 20.vii.1899, *Bodinier* 2662 (E); Tañg-tchañg (Houang tsaò pá), vi.1907, *Esquirol* 1461 (E).

CULTIVATED. Specimens seen from China, England, Scotland, France, the Netherlands, Germany, Finland, U.S.A. (east, central, west, and Hawaii). It is naturalised in New Zealand (S. Island, south-western distr., near Lake Paringa), *fide* W. R. Sykes (in litt. et photo, 1983).

H. kouytchense has a rather restricted distribution in north-western Guizhou. In some respects it seems to be one of the most primitive species in sect. *Ascyreia*, e.g. in its long styles and stamens, acute leaves and sepals, large stellate flowers and conical ovary and capsule. Yet its arching to pendulous habit and petiolate leaves with punctiform laminar glands are relatively advanced characters; and it is clearly related to *H. beanii* and *H. maclarenii*. On the other hand, its acute petal apiculus and long stamens and styles indicate a close relationship with the *H. stellatum* group.

The type specimen of *H. kouytchense* and, probably, *Bodinier* 1774 (which I have not seen) differ from the other material studied (both wild and cultivated) in having more delicate stems, narrowly elliptic to narrowly lanceolate leaves that are smaller and thinner, and smaller flowers with narrower sepals, in all giving the plant a more delicate appearance. These differences suggest that the type is diploid (2n = 20), like *H. uralum*, *H. dyeri* and (by inference from the occurrence of that number in *H.* x 'Rowallane') *H. hookerianum* and *H. leschenaultii*. On the other hand, the cultivated material, as well as *Bodinier* 2662 and *Esquirol* 1461, has stouter stems, thicker, lanceolate to ovate leaves, and larger flowers with broader sepals, all characters that would be expected in the tetraploid that it has proved to be (2n = 40, 36). These numbers support its close relationship with *H. beanii* (2n = 36) and *H. forrestii* (2n = 38, 36); and *H. pseudohenryi* will doubtless also be shown to be tetraploid. When more material has been studied, both morphologically and cytologically, it may be best to treat *H. kouytchense* as two subspecies, diploid and tetraploid. At present, however, I shall maintain it undivided.

36x(47x). **Hypericum kouytchense x calycinum**

This hybrid was made by Mr D. Walker of North Mymms, Hatfield, Herts; but as I do not know if it is still in cultivation and have a specimen of only one flower and two pairs of leaves (coll. 18.ix.1976), I have refrained from naming it or describing it in detail. It is intermediate between the parents, having lanceolate to elliptic, apiculate

Map 26 Sect. 3. *Ascyreia*: 33. *H. maclarenii* ▲, 36. *H. kouytchense* ✪, 37. *H. stellatum* ☆, 38. *H. lancasteri* ●, 39. *H. curvisepalum* □.

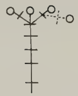
leaves with rather dense but obscure tertiary reticulation beneath; a flower 80 mm in diam.; sepals 10–12 × 6–7 mm, broadly elliptic and rounded-apiculate; petals 40 × 28 mm, intermediate in form with uncinate to obtuse subterminal apiculus; stamens 16–17 mm long, 0·4 × petals, with yellow anthers; and ovary ovoid, 10 × 6 mm, with styles 13 mm (1·3 × ovary), gradually outcurving.

36xx(47xx). **Hypericum** x 'Eastleigh Gold'

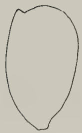
Hilliers' man. trees & shrubs: 150 (1971). Standard specimen: cultivated at Ampfield, Hampshire, Hilliers' Jermyns Lane Nursery, 24.vii.70, *Lancaster* s.n. (BM!).

H. beanii 'Eastleigh Gold' N. Robson in *J. Roy. Hort. Soc.* **95**: 488 [491 in synon.] (1970).

Shrub to *c.* 1 m tall, loose, with spreading drooping branches. *Stems* reddish, 4-lined and ancipitous when young, soon 2-lined, eventually terete, stout; internodes 20–60 mm long, shorter than to exceeding leaves; bark reddish-brown. *Leaves* petiolate, with petiole *c.* 1 mm long; lamina 25–51 × 10–25 mm, elliptic-oblong to oblong-lanceolate, obtuse to rounded, margin plane, base ± broadly cuneate to rounded, paler or somewhat glaucous beneath, chartaceous; venation: *c.* 4 pairs main laterals, with scarcely visible subsidiaries, without visible tertiary reticulum; laminar glands dots and short streaks; ventral glands dense. *Inflorescence* 1–4-flowered, from apical



node, rather lax; bracts foliaceous or reduced and lanceolate, deciduous. *Flowers* 50–65 mm in diam., subcyathiform; buds narrowly ovoid, acute to subapiculate. *Sepals* 10–12 × 2·5–4·5 mm, free, not imbricate, equal to subequal, outcurved in bud and fruit, narrowly oblong or narrowly oblong-lanceolate, acute to acuminate, with margin entire; midrib visible, veins not prominent; laminar glands linear, *c.* 10. *Petals* golden yellow, not tinged red, slightly incurved, 30–35 × 20–25 mm, *c.* 3 × sepals, oblong-obovate, with apiculus subterminal, obtuse; inner margin minutely denticulate. *Stamen fascicles* each with 30–50 stamens, longest 10–12 mm long, 0·3–0·4 × petals; anthers deep yellow. *Ovary* 7·5–8 × 4 mm, narrowly ovoid-conic; styles 5·5–6·5 mm long, 0·75–0·9 × ovary, free, erect, outcurved towards apex; stigmas small. *Capsule c.* 12 × 6 mm (or larger ?), narrowly conic, often puckered. *Seeds* not seen. 2n = ?



Hybrid (?) seedling in cultivation.

CULTIVATED. Specimens seen from England (The Hillier Arboretum, Ampfield, Hampshire (see type); Chelsea Physic Garden, London; Royal Botanic Gardens, Kew; Wakehurst Place, W. Sussex).

Hypericum x 'Eastleigh Gold' arose *c.* 1964 as a seedling in the Eastleigh Nursery of Messrs Hillier & Sons and was selected by R. Alford (nursery foreman). It was first included by me provisionally under *H. beanii* as a cultivar (1970) but later treated as a cultivar unassigned to species (1971). It is almost certainly of hybrid origin and therefore justifies the above use of the hybrid sign; but its parentage is not clear. *H. kouytchense* appears to be involved (shape of sepals and ovary), and the oblong, rather glaucous leaves suggest *H. acmosepalum* as the other parent; but the short stamens would seem to rule it out. *H. hookerianum* would provide the short stamens and even possibly the leaf shape, but not the sepal shape. Perhaps cytological studies would provide the answer to this problem.

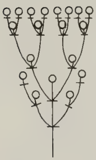
37(48). **Hypericum stellatum** N. Robson

in *J. Roy. Hort. Soc.* **95**: 493, f. 237 (1970); [Lancaster], *Hilliers' Man. trees & shrubs*: 152 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 422 (1973). Type: cultivated in Hort. Kew. ex France, Les Barres (de Vilmorin), 14.vii.1904, *Bean* (K!, holotype).

H. lysimachioides sensu hort. non Wallich (1831, nomen) nec Boiss. & Noë (1867).
H. dyeri sensu hort.–Plaisted & Lighty in *Nat. hort. Mag.* **38**: 125 (1959); Thomas in *Gdnrs' Chron.* III, **47**: 226 (1960); non Rehder (1939).

Icones: N. Robson in *J. Roy. Hort. Soc.* **95**: f. 237 (1970); Fig. 19B.

Shrub c. 1–2·5 m tall, with branches spreading to subpendulous. *Stems* orange-red, 4-lined and ancipitous when young, soon 2-lined, sometimes becoming terete; internodes 10–31 mm long, shorter than leaves; bark reddish-brown. *Leaves* petiolate, with petiole 1–2 mm long; lamina 20–55 × 10–22 mm, oblong-lanceolate or lanceolate to narrowly ovate, acute to obtuse or rounded-apiculate, margin plane, base cuneate to rounded, paler or sometimes ± densely glaucous beneath, chartaceous; venation: 4(5) pairs main laterals, with midrib branching ± obscurely distally, without visible tertiary reticulum; laminar glands dots and short streaks, ventral glands dense. *Inflorescence* 1–14-flowered, lax, with branches slender, from terminal node; pedicels 10–15 mm long; bracts narrowly lanceolate, deciduous. *Flowers* 25–40 mm in diam., stellate; buds ± broadly ovoid, apiculate to shortly acuminate. *Sepals* 8–13 × 2–5 mm, free, imbricate or open at base, equal, widely spreading to subrecurved in bud and fruit, ± narrowly lanceolate, acute, with margin entire (reddish) midrib conspicuous, veins not prominent; laminar glands linear *c.* 10. *Petals* golden yellow, sometimes tinged red, spreading to shallowly incurved, 12–20 × 8–14 mm, *c.* 1·5 × sepals, obovate, with apiculus subterminal, acute, margin entire or minutely denticulate towards apex. *Stamen fascicles* each with 30–55 stamens, longest 10–13 mm long, *c.* 0·6 × petals; anthers golden yellow. *Ovary* 4–6 × 3–4 mm, ovoid-conic to ovoid; styles 6–9·5 mm long, 1·2–1·5 × ovary, usually



flexuous and ± twisted: stigmas scarcely capitate. *Capsule* 10–15 × 6–8 mm, ovoid. *Seeds* c. 1·1 mm long, dark red-brown, narrowly cylindric, not carinate, shallowly and loosely reticulate. 2n = ?

Thickets and slopes; 800–1350 m.

China (NE. Sichuan). Map 26.
CHINA: Sichuan: Chenkou Xian, 1350 m, 17.vi.1958, *Dai* 100888 (SZ); ibid., 800 m, 27.viii.1958, *Dai* 102054 (SZ).
CULTIVATED. Specimens seen from England (1982), France (1904), Germany (1924), Poland (1912), and U.S.A. (1962).

Hypericum stellatum can be distinguished from *H. dyeri*, with which it has been confused, by the relatively shorter styles (*c.* 1·2–1·5 × ovary, not 1·5–2 ×), larger flowers, broader petals and larger leaves without markedly reticulate venation.
The original concept of *H. stellatum* was based mainly on cultivated plants of unknown origin, but it included some herbarium material of which some has subsequently proved to belong to *H. choisianum* and two hitherto undescribed species, *H. lancasteri* and *H. curvisepalum*. The status of the cultivated specimens, however, has been clarified by recent collections made in Yunnan and from the study of specimens in Chengdu herbarium (SZ). It appears that there are two populations, respectively in northern Yunnan and north-eastern Sichuan, which can be separated by the size of the ovary, the length and form of the styles, the stoutness of the inflorescence, and usually by the density of ventral leaf glands.
The northern population is *H. stellatum* and the southern one, which merits specific status (taking into account the above differences and the geographical disjunction), I have named *H. lancasteri*.

38(49). **Hypericum lancasteri** N. Robson, **sp. nov.**

H. stellato N. Robson affinis, sed foliis lanceolatis vel oblongo-lanceolatis vel triangulari-lanceolatis glandulis superficiebus plerumque haud vel parce instructis, inflorescentiae ramificationibus pro ratione crassioribus, ovario majori stylis quam ovario pro ratione longioribus curvatis haud flexuoso-torsivis, differt. Type: China, Yunnan, above Dali, Qingbixu, 2000 m, 23.v.1981, *Sino-Brit. Exped. Cangshan* 1096 (E!, holotype).

Icon: Fig. 19A.

Shrub 0·3–1 mm tall, with branches suberect to spreading. *Stems* purplish-red, 4-lined but scarcely ancipitous when young, soon 2-lined, eventually terete; internodes 10–40(–60) mm long, shorter than to exceeding leaves; bark reddish-brown. *Leaves* petiolate, with petiole 1–1·5 mm long; lamina 30–60 × 9–30 mm, oblong-lanceolate or lanceolate to triangular-lanceolate, acute to rounded, margin plane, base cuneate to rounded, paler or sometimes ± densely glaucous beneath, chartaceous; venation: 3–4 pairs main laterals, with midrib branching distally, without visible tertiary reticulum; laminar glands dots and short streaks, ventral glands usually sparse or absent. *Inflorescence* 1–11-flowered, lax, with branches relatively stout, from 1–3 nodes; pedicels 13–30 mm long; bracts foliaceous, gradually reduced in successive nodes, deciduous. *Flowers* 30–55 mm in diam., ± stellate to subcyathiform; buds narrowly to broadly ovoid, acute to apiculate or subacuminate. *Sepals* 8–11 × 3–4 mm, free, imbricate, unequal or equal, outcurved to widely spreading in bud, widely spreading to recurved in fruit, lanceolate to ovate or oblong-ovate, acute to subacuminate, with margin entire (reddish); midrib conspicuous, veins not prominent; laminar glands *c.* 10. *Petals* golden yellow, not tinged red, spreading to shallowly incurved, 17–28 × 13–18 mm, *c.* 2–2·5 × sepals, oblong-obovate, with apiculus subterminal to lateral, acute to obtuse, margin entire. *Stamen fascicles* each with *c.* 45–50 stamens, longest 11–16 mm long, *c.* 0·6 × petals; anthers golden yellow. *Ovary* 5–6·5 × 3·5–5 mm, ovoid; styles 5–7 mm long, 1–1·2 × ovary, outcurved distally, not twisted; stigmas scarcely capitate. *Capsule* 13–17 × 8–10 mm, ovoid. *Seeds* dark red-brown, 1–1·3 mm long, narrowly cylindric, not or incompletely carinate, shallowly and loosely reticulate. 2n = ?

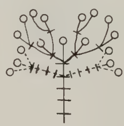


Fig. 19 A. *H. lancasteri*: (a) habit; (b) leaf section; (c) ovary. B. *H. stellatum*: (d) habit; (e) leaf section; (f) ovary. C. *H. curvisepalum*: (g) habit; (h) leaf section; (i) ovary (a, d, g × 1; b, c, e, f, h, i × 4). A. *S.B.E.C.* K036; B. *Robson* s.n.; C. *Schneider* 1550.

Dry grassy banks and slopes; 1750–2550 m.

China (N. Yunnan, S. Sichuan). Map 26.
CHINA. Yunnan: Kunming, Hua Hong Dong, 2000 m, 26.iv.1981, *Sino-Brit. Exp. Cangshan* K001 (E), K992 (E), K036 (BM, E); K039 (E); Kunming, Western Hills, *c.* 2500 m, 17.x.1980, *Lancaster* L. 750 (BM), *Rushforth* KR 327 (E); Tali [Dali] Range, 1906, *Forrest* 4300 B (BM); Cangshan, above Yangbi, Xieshanhe, 1850 m, v.1981, *Sino-Brit. Exp. Cangshan* 34 (E); Tong-tchouan [Hweitseh], 2550 m, vi.1913, *Maire* s.n. (E). Sichuan: Huidong Xian, 1750 m, 3.vii.1978, *Zhao* 5802 (SZ).
CULTIVATED. Specimens seen from England (1984) and Scotland (1982), ex *Lancaster* L. 749, L. 750 and *Rushforth* KR327.

For a comparison between *H. lancasteri* and *H. stellatum* see after description of the latter (p. 279).

39(50). **Hypericum curvisepalum** N. Robson, **sp. nov.**

H. lancasteri N. Robson affinis, sed floribus minoribus profunde cyathiformibus, staminibus petalis circa triplo brevioribus, stylis ovario circa duplo brevioribus, capsulis valvis crassioribus, differt. Type: China, Sichuan, 'inter Woloho et Humati', *C. Schneider* 1550 (E!, holotype; K!, isotype).

Icon: Fig. 19C.

Shrub 0·3–1·2 m tall, with branches spreading to pendulous. *Stems* yellow-brown (young parts purplish at first), 4-lined when young, soon terete, slender, internodes 10–25 mm long, shorter than leaves; bark grey-brown. *Leaves* petiolate, with petiole 0·5–1 mm long; lamina 20–40 × 8–20 mm, triangular- lanceolate to triangular-ovate, acute or more rarely obtuse to rounded, margin plane, base rounded to shallowly cordate, ± glaucous beneath, chartaceous; venation: 3–4 pairs main laterals, branched, the midrib pinnately branched, with tertiary reticulum obscure or invisible; laminar glands streaks (occasionally elongate) and dots. *Inflorescence* 1(3)-flowered, from apical node; pedicels 6–10 mm long; bracts linear or usually foliar. *Flowers* 20–40 mm in diam., deeply cyathiform; buds ovoid, acute to apiculate. *Sepals* 8–14 × 3–5 mm, free, imbricate, unequal, outcurved or spreading and purplish in bud and fruit, ovate to lanceolate or narrowly elliptic, subacute to acuminate or rarely apiculate-obtuse, margin entire, midrib narrow sometimes indistinct; laminar glands linear, interrupted distally, 8. *Petals* deep yellow, markedly incurved, 12–22 × 8–17 mm, 1·1–1·5(–2) × sepals, broadly obovate to subcircular, with apiculus subterminal, obtuse to rounded; margin entire, eglandular. *Stamen fascicles* each with *c.* 60 stamens, longest 10–12 mm long, 0·35–0·7 × petals; anthers deep (?) yellow. *Ovary* 6–8 × 4·5–6 mm, ± broadly ovoid; styles 3–4 mm long, *c.* 0·5 × ovary, free, outcurved near apex; stigmas narrowly or scarcely capitate. *Capsule* (12)14–17 × 8–10 mm, ovoid-conic to broadly ovoid, with thickly coriaceous valves. *Seeds* dark reddish-brown, 0·8–1 mm long, cylindric, not winged, not or scarcely carinate, shallowly linear-foveolate. 2n = ?

Dry or rocky hillsides and open woodland; 1800–3000 m.

China (north Yunnan, south Sichuan, west Guizhou). Map 26.
CHINA. Yunnan: *c.* 15 km W. of Kunming, Western Hills, around Tai Hua Temple, 2300 m, 24.iv.1981, *Sino-Brit. Exp. Cangshan* K.118 (E); Tali Range, 1906, *Forrest* 4300A (BM); above Dali, Qingbixu, 2300 m, 23.v.1981, *Sino-Brit. Exp. Cangshan* 1081 (E); above Weishan, Santaipo, S. end of Cangshan, 2350 m, 21.v.1981, *Sino-Brit. Exp. Cangshan* 1198 (BM); above Yangbi, Zhaimen, 2400 m, 6.v.1981, *Sino-Brit. Exp. Cangshan* 0283 (E); Tong-Tchouan, 2500–2600 m, v.1913, *Maire* 443/1913 (E), 444/1913 (BM, E); Tehching, Wuyen, 2400 m, 2.vi.1937, *Yü* 8401 (BM). Sichuan; between Woloho and Humati, 2800–3000 m, 14.vi.1914, *Schneider* 1550 (E, K). Guizhou: Pu'an Xian, 1800 m, 7.ix.1959, *Anchuan Team* 1176 (KUN).
CULTIVATED. Specimens seen from England (1983).

H. curvisepalum is clearly derived from *H. lancasteri*, which has shorter styles than *H. stellatum* and sometimes 1-flowered inflorescences. In general, however, *H. curvisepalum* has smaller, more deeply cup-shaped, nodding flowers with relatively shorter stamens and styles; and it is usually more slender and delicate except for the fruits which, although smaller, tend to be rather massive. Its leaves tend to be shorter and broader and have a shorter petiole and longer translucent glandular streaks.

I was reluctant, at first, to describe two closely related species with such overlapping distributions; but the above differences seem to be constant. It seems possible, therefore, that *H. lancasteri* gave rise to *H. curvisepalum* by 'trend variation' and subsequent isolation, and that the present syntopy of these taxa is secondary.

40(51). **Hypericum beanii** N. Robson

in *J. Roy. Hort. Soc.* **95**: 490, excl, f. 235 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 150 (1971); Bean, *Trees & shrubs hardy in Br. Isles* ed. 8, **2**: 406 (1973). Type: Cultivated, R.B.G. Kew ex China, Yunnan (*Henry* 179/1898), 4.x.1899 (K!, holotype).

H. patulum var. *henryi* Veitch [in *Gdnrs' Chron.* III, **36**: 229 (1904), nomen] ex Bean in *Gdnrs' Chron.* III, **38**: 179 (1905); Plaisted & Lighty in *Nat. Hort. Mag.* **38**: 124 (1959); Thomas in *Gdnrs' Chron.* III, **147**: 226 (1960). Type as for *H. beanii*.

H. pseudohenryi sensu N. Robson in *Yb. int. Dendr. Soc.* **1980**: 141 (1981).

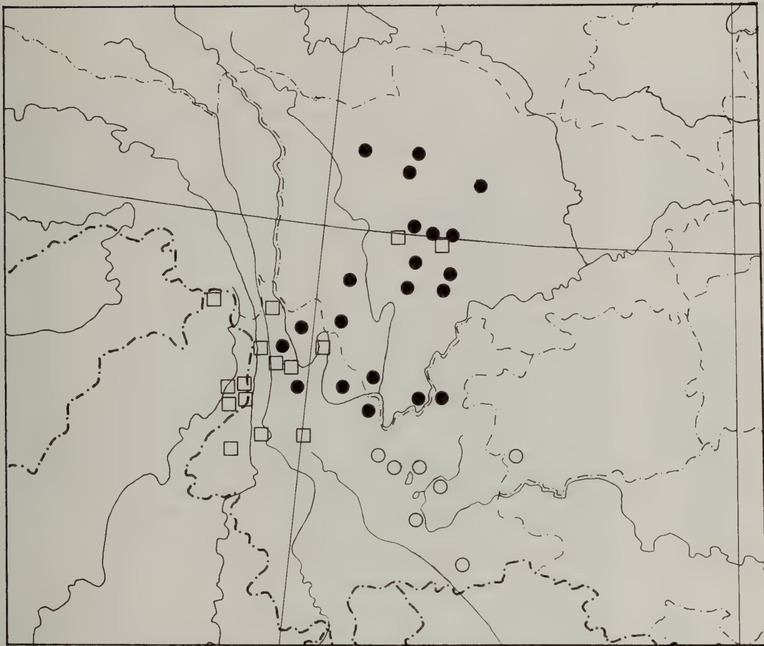
Icon: Lancaster in *Yb. int. Dendr. Soc.* **1980**: 124, t. 54 (1981) as *H. pseudohenryi*.

Shrub 0·6–2 m tall, bushy, with branches erect or arching. *Stems* red to orange, 4-angled and ancipitous at first, eventually terete; internodes 5–40(–50) mm long, shorter than or exceeding leaves; bark reddish brown. *Leaves* petiolate, with petiole 1–2·5 mm long; lamina 25–65 × 10–35 mm, narrowly elliptic or oblong-lanceolate to lanceolate or ovate-lanceolate, acute or apiculate to obtuse or sometimes rounded, margin plane, base cuneate to rounded, paler or glaucous beneath, chartaceous to subcoriaceous; venation: (2)3–5 pairs of main laterals, all free or the upper forming a partial undulating intramarginal vein, the midrib branching distally, with lax obscure tertiary reticulum; laminar glands dots and short to ± long streaks, ventral glands dense, sometimes only near midrib, or absent. *Inflorescence* 1–14-flowered, from apical node, subcorymbiform, often with lateral flowering branches below; pedicels 3–20 mm long; bracts foliar to narrowly lanceolate, persistent. *Flowers* 30–45 mm in diam., stellate to cyathiform; buds ovoid-conic to broadly ovoid, acute to bluntly apiculate. *Sepals* 6–11(–14) × 3–6·5(–10) mm, free, imbricate (sometimes markedly so), equal or subequal, erect to spreading in bud and fruit, ovate to oblong-ovate or broadly elliptic, acute or apiculate to obtuse with margin hyaline, entire or distally minutely denticulate; midrib conspicuous, ± prominent, veins rarely conspicuous; laminar glands linear, ± interrupted distally, *c.* 10–14. *Petals* golden yellow, not red-tinged, spreading to rather deeply incurved, 15–33 × 10–30 mm, *c.* 2–4·5 × sepals, oblong-obovate to subcircular, with apiculus lateral to subterminal, obtuse to rounded; margin entire to irregularly eroded-denticulate, eglandular. *Stamen fascicles* each with 40–55 stamens, longest 10–15 mm long, 0·5–0·7 × petals; anthers golden yellow. *Ovary* 6–9 × 4–5 mm, ovoid-pyramidal to narrowly ovoid-cylindric; styles 4–9 mm long, 0·65–1·1 × ovary, free, suberect, outcurved near apex; stigmas narrowly capitate to truncate. *Capsule* 15–20 × 8–11 mm, narrowly ovoid-conic to ovoid. *Seeds* dark reddish- to purplish-brown, 1–1·5 mm long, narrowly cylindric, broadly carinate, shallowly linear-reticulate. 2n = 36.

In open forest or thickets or by streams, and on grassy or stony slopes; 1500–2400 m.

China (E. Yunnan, W. Guizhou). Map 27.

CHINA. Yunnan: Kunming, Hua Hong Dong, 2100 m, 18 × 1980, *Lancaster* 752 (BM); vicinity of Yunnan-sen [Kunming], [rec. xi.1906], *Maire* 291 (E); near Kunming, Dashao, 2400 m, 26.iv.1981, *Sino-Brit. Exped. Cangshan* K. 047 (BM, E); Little Stone Forest, *c.* 120 km SE. of Kunming, 1750 m, 19.x.1980, *Lancaster* L.711 (BM); Mengtze, south mountains, 1500 m, 1897?, *Henry* 9986 (K). Guizhou: Tcheou-fong, viii.1904, *Esquirol* 187 (E).



Map 27 Sect. 3. *Ascyreia*: 40. *H. beanii* ○, 41. *H. pseudohenryi* •, 42. *H. forrestii* □.

CULTIVATED. England: Kew, Royal Botanic Gardens, Arboretum, 19.ix.1905, *Henry* 179/1898 (K); Hampshire, Ampfield, Jermyns Lane Nursery, 3.viii.1970, *Lancaster* s.n. (BM). Specimens of *Lancaster* L.711 (Little Stone Forest), L.751 and 752 (Hua Hong Dong) and L.653 (Western Hills), all from near Kunming, flowered in England and Scotland in 1982 or 1983.

H. beanii is a variable species that shows affinities on the one hand with *H. kouytchense* and on the other with *H. pseudohenryi* and *H. forrestii*. It shows a north to south cline from (i) a form with leaves elliptic, acute, with long glandular streaks, flowers stellate or shallowly cyathiform and stamens and styles relatively long to (ii) a form with leaves ovate, obtuse to rounded, with very short glandular streaks or dots, flowers deeply cyathiform and stamens and styles relatively short.

The type of *H. beanii* is a cultivated specimen grown at Kew from seed sent by Dr Henry in 1898 from Yunnan, probably from the Mengtze region.

41(52). **Hypericum pseudohenryi** N. Robson

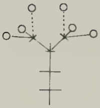
in *J. Roy. Hort. Soc.* **95**: 493 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 152 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed.**2**: 406 (1973). Type: China, Yunnan, Chung-tien district, north of Chung-tien in Tonwa Territory, 3000 m, iv–v.1932, *Rock* 24673 (BM!, holotype; A!, E!, K!, isotypes).

H. patulum sensu R. Keller in *Bot. Jahrb.* **44**: 48 (1909), non Thunb. ex Murray (1784).

H. patulum var. *henryi* sensu Rehder in Sargent, *Pl. Wils.* **2**: 403 (1915) et hort. pro parte, non Veitch ex Bean (1905).

H. henryi sensu hort. pro parte, non H. Léveillé & Vaniot (1908).

Icon: Fig. 20.



Shrub 0·7–1·7 m tall, ± spreading, with branches erect to arching. *Stems* red, 4-angled and ancipitous in first year, then terete, stout; internodes 8–60 mm long, shorter than to exceeding leaves; bark grey-brown. *Leaves* petiolate, with petiole 0·5–1 mm long; lamina 20–66(–80) × 5–35 mm, ovate or ovate-oblong to lanceolate or lanceolate-oblong, rounded or rarely apiculate-obtuse, margin plane, base narrowly to ± broadly cuneate, paler or somewhat glaucous beneath, chartaceous; venation: 2–3 pairs of main laterals (the upper forming distinct undulating intramarginal vein), the midrib branched distally, with lax obscure tertiary reticulum; laminar glands dots and short streaks; ventral glands densest or present only near midrib. *Inflorescence* 1–7(–*c.* 25)-flowered, subcorymbiform, from apical node; pedicels 4–11 mm long; bracts foliar to narrowly lanceolate, persistent. *Flowers* 30–55 mm in diam., stellate to subcyathiform, buds ovoid-pyramidal, subacute. *Sepals* 6–9(–13) × 3–7 mm, free, imbricate, subequal, erect to outcurved in bud and fruit, broadly to narrowly ovate-oblong, acute or subacuminate to obtuse, with margin narrowly hyaline, entire or minutely denticulate towards apex; midrib conspicuous, veins not prominent; laminar glands linear, 8–10. *Petals* golden yellow, not red-tinged, spreading to reflexed, 16–30 × 10–17 mm, 2·5–3 × sepals, obovate, with apiculus subterminal, obtuse; margin entire to irregularly eroded-denticulate, eglandular. *Stamen fascicles* each with *c.* 40 stamens, longest 14–20 mm long, 0·75–0·85 × petals; anthers golden-yellow. *Ovary* 5–9 × 3·5–6 mm, ± broadly ovoid; styles 5·5–11 mm long, somewhat longer than ovary, free, suberect to divergent, outcurved near apex; stigmas truncate. *Capsule* 12–17 × 10–14 mm, ovoid-conic to ovoid. *Seeds* dark orange-brown, 15–20 mm long, narrowly cylindric, narrowly carinate, shallowly linear-reticulate. 2n = ?

Pine forest, thickets, dry grassy or stony slopes; 1400–3800 m.

China (north Yunnan, central Sichuan). Map 27.

CHINA. Yunnan: Dongchuan Shi [Hweitseh], 2740 m, 12.viii.1964, *Dian Dongbei group* 468 (KUN); Lichiang Snow Range, 2800 m, 29.viii.1937, *Yü* 15503 (BM, E); in regione Yungning-Yungpeh inter Pij et Paoto, *c.* 2600 m, 25.vi.1914, *Schneider* 3054 (E). Sichuan: Muli, Wachin, Yatsa, 3100 m, 5.xi.1937, *Yü* 14729 (BM, E); Tachien-lu [Kangding], 1500–2400 m, xi.1908, *Wilson* 1355. (BM, K); west and near Wênchuan Hsien, 1200–1800 m, vii.1908, *Wilson* 2418 (BM, E, K); Huidong Xian, 2550 m, 20.vii.1960, *Hu* 60–1390 (SZ); Tianquan Xian, 1700 m, 7.vi.1953, *Tsiang* 34335 (SZ).

IRELAND (naturalised). Co. Cork, Glengariff, Glengariff wood, 3.viii.1983, *Stern* s.n. (BM).

CULTIVATED. Specimens seen from England (1919–1983), Ireland (1973–1980), France (1926), the Netherlands (1933–1936), Finland (1933), and the U.S.A. (1911–1959).

H. pseudohenryi is related to *H. beanii* but has a distribution (in north-western Yunnan and Sichuan) wholly to the north-west of that species. It differs from it in its oblong-lanceolate to oblong-ovate leaves, usually with a rounded apex and a quite marked partial intramarginal vein, and its ovoid (not pyramidal) capsules. *H. pseudohenryi* appears to be one of the commonest species of sect. *Ascyreia* in Sichuan, along with *H. monogynum* and *H. patulum*.

Two specimens appear to be intermediate between *H. pseudohenryi* and *H. lagarocladum*: Sichuan: Tianquan Xian, 21.v.1956, *He* 44087 (SZ); Yanyuan, 1900 m, 23.v.1978, *Zhao et al.* 4586 (SZ). Since both localities are in the region where the distributional areas of these species overlap, it seems likely that these specimens are hybrids.

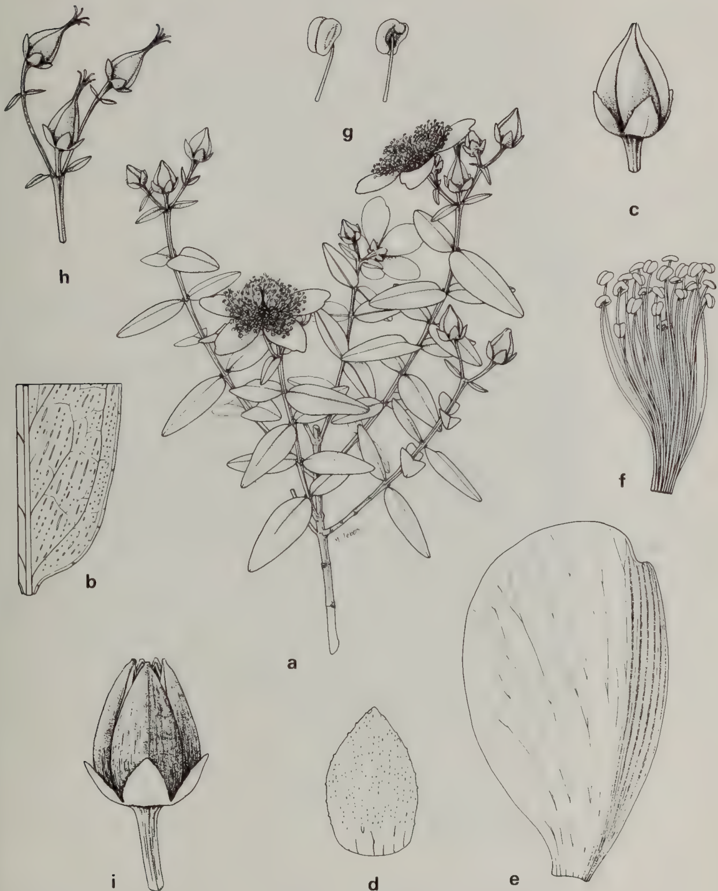


Fig. 20 *H. pseudohenryi*: (a) habit; (b) leaf section; (c) flower bud; (d) sepal; (e) petal; (f) stamen fascicle; (g) anthers; (h) inflorescence in young fruit; (i) capsule (a, h × 1; b, c, i × 4; d–f × 6; g × 20). All *Forrest* 5885.

42(53). **Hypericum forrestii** (Chittenden) N. Robson

in *J. Roy. Hort. Soc.* **95**: 491, f. 242 (1970); [Lancaster], *Hilliers' man. trees & shrubs*: 151 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 412 (1973). Type: cultivated, R.B.G. Kew ex China, Yunnan (*Forrest* A.669), 11.vii.1922, *Hort. Kew.* H. 1061 (K!, holotype).

H. hookerianum sensu Rehder in Sargent, *Pl. Wils.* **2**: 403 (1915) pro parte excl. spec. *Pratt* 292; Hand.-Mazz., *Symb. sin.* **7**: 401 (1931).

H. patulum 'Rothschild's Form' Bean in *Gdnrs' Chron.* III, **72**: 235, f. 93 (1922), nomen.

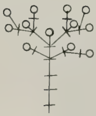
H. patulum var. *forrestii* Chittenden in *J. Roy. Hort. Soc.* **48**: 234 (1923); Plaisted & Lighty in *Nat. Hort. Mag.* **38**: 124 (1959); Thomas in *Gdnrs' Chron.* III, **147**: 226 cum fig. (1960); Schneider in *Meded. Inst. Vered. Touinbougew, Wageningen* **252**: 21 (1966), in *Dendrofl.* **2**: 21 (1967) pro parte excl. fig. et syn. *H. patulum grandiflorum, H. patulum* 'Sungold'.

H. patulum forma *forrestii* (Chittenden) Rehder, *Bibl. cult. trees & shrubs*: 463 (1949).

H. calcaratum hort., nomen.

H. patulum var. *henryi* sensu hort. pro parte, non Bean (1904).

Icones: Thomas in *Gdnrs' Chron.* III, **147**: 227 (1960); also Bean (1922) and Robson (1970) supra cit.



Shrub 0·3–1·5 m tall, bushy, with branches ± erect. *Stems* red to orange, 4-angled and slightly ancipitous when young, soon terete; internodes 10–45(–60) mm long, shorter than or rarely exceeding leaves; bark grey-brown, smooth, fissuring. *Leaves* petiolate, with petiole 0·5–2 mm long, ± broad; lamina 20–53(–60) × 9–32(–35) mm, lanceolate or triangular-ovate to ± broadly ovate, obtuse to rounded or slightly retuse, margin plane, base broadly cuneate to rounded, paler beneath, chartaceous; venation: 4–5 pairs main laterals, forming undulating intramarginal vein with midrib branches, with obscure or invisible tertiary reticulum; laminar glands short streaks and dots; ventral glands dense, especially near midrib. *Inflorescence* 1–*c.* 20-flowered, from 1 or occasionally 2 nodes, subcorymbiform, pedicels 4–10 mm long; bracts lanceolate to ± foliaceous, persistent. *Flowers* (25–)35–60 mm in diam., ± deeply cyathiform; buds broadly ovoid, obtuse to rounded. *Sepals* 6–9 × 3–8 mm, free, imbricate, subequal to equal, erect in bud and fruit, ovate or ± broadly elliptic to subcircular, rounded or rarely subapiculate, with margin entire or finely eroded-denticulate towards apex and often ± hyaline; midrib distinct, veins not prominent; laminar glands linear, ± interrupted distally, 12 or more. *Petals* golden yellow, not tinged red, markedly incurved, 18–30 × 11–25 mm, 3–3·5 × sepals, broadly obovate, with apiculus subterminal, rounded; margin entire (?) or remotely glandular-subdenticulate. *Stamen fascicles* each with 40–65 stamens, longest 10–15 mm long, 0·4–0·6 × petals; anthers golden yellow. *Ovary* (4·5–)6–8 × 4–4·5 mm, broadly ovoid; styles 4–7 mm long, 0·7–0·9(–1) × ovary, free, outcurved near apex; stigmas small. *Capsule* 12–18 × 8–14 mm, ± broadly ovoid. *Seeds* dark reddish-brown, 1–2–1·7 mm long, narrowly cylindric, distally slightly carinate or winged, very shallowly scalariform-reticulate. 2n = 36, 38.

Open stony situations on hillsides, sometimes by streams or at *Pinus* forest margins; 1500–3300(–4000 ?) m.

China (N.W. Yunnan, S.W. Sichuan), N.E. Burma. Map 27.

CHINA. Sichuan: Tachien-lu [Kangding], 1500–2600 m, vii.1908, *Wilson* 1355a (BM, EK); ibid., 2100–2500 m, x.1910, *Wilson* 4338 (K); Gongshan [Kungshan], 22.xi.1959, *Feng* 24188 (KUN); Tianquan Xian, 23.vii.1953, *Tsiang* 34993 (SZ). Yunnan: Tsekou, *c.* 1904, *Monbeig* (K); N. end of Lichiang valley, 2700–4150 m, vi.1906, *Forrest* 2425 (E, K); E. flank of Tali [Dali] Range, 25°40'N, 2100–3300 m, vi.–ix.1906, *Forrest* 4300 (BM, E, K); hills around Tengyueh, 25°N, 1500–2100 m, viii.1912, *Forrest* 7743 (BM, E, K); Salwin valley, Yuragan, 1700 m, 22.vii.1938, *Yü* 23076 (E).

BURMA. Kachin: Ridge of Naung chaung/Nmai Divide, 1200–1800 m,

20.vii.1914, *Kingdon Ward* 1843 (E); Myitkina, 4·8 km from Kangfang, 16.vi.1938, *Naw Mu Pa* 17415 (K).

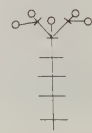
CULTIVATED. Specimens seen from England, Scotland, Ireland, France, Germany, Finland, and the U.S.A.

H. forrestii is closely related to *H. beanii*, differing from it in having a terete stem, more ovate, rounded leaves, a more deeply cyathiform flower with rounded sepals, somewhat relatively shorter stamens and usually relatively shorter styles, and a broadly ovoid rather than ovoid to ovoid-conic capsule. *H. forrestii* usually occurs at much higher altitudes than does *H. beanii*, and, since Forrest's plants that were the original source of cultivated material were collected at *c.* 3000–4000 m, it has proved to be quite hardy in northern Europe. *H. forrestii* therefore replaced *H. beanii* in popularity as a garden plant in the period from *c.* 1920–1950; but it, in turn, was replaced by *H.* x 'Hidcote'.

42x(53x). **Hypericum** x **dummeri** N. Robson, **hybr. nov**.

42. *H. forrestii* x 14. *H. calycinum*

Hybrida hortensis e *Hyperico forrestii* N. Robson et *H. calycino* L. genita, foliis oblongo-ovatis ad 50 mm longis subtus pallidis manifeste sed laxe reticulato-venatis, floribus leviter cyathiformibus in alabastro cinnabarinis coloratis, staminibus quam petalis 2·5 plo brevioribus antheris aurantiacis, stylis ovario circa 1·2 plo longioribus, et aliis characteribus inter parentes media. Type: cultivated at Limpsfield, Surrey, viii.1982, *Robson* 1901 (BM!, holotype).



Shrub up to *c.* 0·7 m tall, lower and with branches more spreading-ascending than in *H. forrestii*. *Stems* red, 4-angled but not ancipitous when young, eventually terete; internodes 25–35 mm long, shorter than leaves; bark reddish-brown. *Leaves* petiolate, with petiole *c.* 2 mm long; lamina 35–48 × 18–22 mm, oblong-ovate, rounded to subapiculate, base cuneate, markedly paler or somewhat glaucous beneath, subcoriaceous; venation: *c.* 4 pairs of main laterals, with marked but lax tertiary reticulum; laminar glands dots and short streaks, obscure; ventral glands dense to sparse. *Inflorescence* 1–4-flowered, from 1 node, subcorymbiform; pedicels 3–6 mm long; bracts reduced, elliptic. *Flowers* *c.* 55 mm in diam., shallowly cyathiform; buds broadly ovoid, rounded. *Sepals* 6–9 × 6–8 mm, broadly oblong to obovate or subcircular, rounded, with margin eroded-denticulate, hyaline and submarginal zone red; midrib obscure, veins not prominent; laminar glands linear, *c.* 13. *Petals* deep golden yellow, tinged orange-red outside, *c.* 30 × 23 mm, *c.* 4–5 × sepals, narrowly obovate, with apiculus lateral, rounded to obsolete; margin minutely eroded-denticulate towards apex. *Stamen fascicles* each with 25–27 stamens, 12 mm long, 0·4 × petals; anthers deep orange. *Ovary* 7 × 6 mm, ovoid; styles 8 mm long, *c.* 1·2 × ovary, free, erect, gradually outcurved; stigmas small. *Capsule* dark red when immature. *Seeds* not seen.

CULTIVATED. England, Herts, North Mymms, 22.vii.1973, *D. Walker* s.n. (BM).

H. x *dummeri* is named after Mr Peter Dummer of Hilliers' Nurseries (now The Hillier Arboretum), Ampfield, Hants, who, at my suggestion, made the cross that resulted in the above hybrid. The cross (♀ *forrestii* x ♂ *calycinum*) was made (*c.* 1975) in an attempt to re-create *H.* 'Hidcote'; but the resultant hybrid is clearly different from the latter (q.v.). It is nevertheless a striking plant, with the deep green of the upper surface of the leaf contrasting with the paler reticulate-veined lower surface; and the deep reddish flower buds and young fruits, together with the orange anthers and lowish, spreading habit, make it quite distinct from other members of sect. *Ascyreia*. Somewhat earlier (1971) another hybridiser, Mr D. Walker of North Mymms, Hatfield, Herts, made the same cross with similar results. His plants were completely sterile. A seedling from the Dummer cross growing at Chelsea Physic Garden has no red tinges on the petals. *H.* x *dummeri* thus appears to be variable, and so I propose to treat the clone described above as a cultivar: c.v. 'Peter Dummer'. According to Mr Dummer (in litt. 20.x.1977), the hybrid occasionally produces variegated shoots (c.f. *H.* x *moserianum* and *H.* x 'Hidcote').

Sect. 4. **TAKASAGOYA** (Y. Kimura) N. Robson

in *Blumea* **20**: 252 (1973).

Shrubs or shrublets up to *c.* 1·5 m tall, deciduous, glabrous, without dark glands; branching lateral. *Stems* 4-lined and ± ancipitous when young, often eventually terete, eglandular; cortex exfoliating in long scales; bark smooth, scaly. *Leaves* opposite, decussate, sessile or subsessile, free, deciduous at basal articulation; lamina entire, with venation pinnate, usually partially or completely closed, the tertiary reticulum almost invisible or obscure; laminar glands punctiform, pale; marginal gland dots pale; ventral glands absent. *Inflorescence* 1–3-flowered, branching dichasial/monochasial from up to 14 nodes sometimes with subsidiary branches; bracts foliar, bracteoles ± reduced. *Flowers* stellate to cyathiform, homostylous. *Sepals* 5, free or united at the base, persistent, with margin entire; veins 5–9; laminar glands ± pale, linear to punctiform; inframarginal and marginal glands absent. *Petals* 5, deciduous, with apiculus present, subterminal, sometimes much reduced, or absent, and margin entire; marginal glands absent; laminar glands ± numerous, pale, linear to punctiform. *Stamen fascicles* 5, free, deciduous, each with 6–*c.* 40 stamens; filaments united very shortly; anthers yellow, with gland amber; pollen type III. *Ovary* with 5 incompletely or completely axile placentae, ∞-ovulate; styles 5, completely united; stigmas completely united, forming capitate to ellipsoid or subglobose mass. *Capsule* 5-valved, coriaceous, not vittate. *Seeds* cylindric to clavate, narrowly carinate to laterally winged, with apical expansions sometimes wing-like; testa linear-reticulate to scalariform-reticulate.

Basic chromosome number (x): ?; ploidy ?.

Habitat: stony or rocky slopes or clefts; 0–2400 m.

Distribution: Ryukyu Is. (Uotori I.), Taiwan, Philippines (Luzon).

5 species (+ 1 subspecies).

Sect. *Takasagoya* appears to be derived from sect. *Ascyreia*, *H. subalatum* being most closely related to *H. monogynum* form (i) 'salicifolium' or the form of that species native (?) in Taiwan. (See p. 235 and Fig. 4, p. 170.)

Key to sect. 4. *Takasagoya*

1 Sepals 3·5–10 mm long, mostly lanceolate or narrowly elliptic to linear, acute to subacute (or rarely rounded), often with distinct midrib 2
Sepals 1–3 mm long, mostly broadly ovate to oblong, obtuse to rounded, without distinct midrib 4

2(1) Stems terete when mature; leaves ovate to elliptic or obovate, subacute to rounded 3
Stems 4-angled to 4-winged when mature; leaves usually narrowly elliptic to lanceolate, acute to subacute .... 5. ***subalatum*** (p. 296)

3(2) Sepals obovate to lanceolate, 7–10 mm long, ascending in fruit; petals 10–20 mm long; leaves ovate to elliptic .... 1. ***formosanum*** (p. 289)
Sepals linear-lanceolate, 3·5–8 mm long, reflexed in fruit; petals 20–28 mm long; leaves elliptic to obovate .... 2. ***nakamurai*** (p. 289)

4(1) Flowers from up to 14 nodes below apex, substellate; capsule narrowly cylindric or cylindric-ellipsoid to cylindric-conic 5
Flowers terminal, solitary, cyathiform; capsule narrowly ovoid .... 3. ***senkakuinsulare*** (p. 292)

5(4) Styles 1·3–2 × as long as ovary; sepals 1–2·5 mm long; branches often spreading and pendulous .... 4a. ***H. geminiflorum*** subsp. ***geminiflorum*** (p. 294)
Styles about as long as ovary; sepals 2·5–3 mm long; branches erect or ascending .... 4b. ***H. geminiflorum*** subsp. ***simplicistylum*** (p. 295)

1(54). **Hypericum formosanum** Maxim.

in *Bull. Acad. Sci. St. Petersb.* **27**: 428 (1881), in *Mél. Biol.* **11**: 160 (1882); Forbes & Hemsley in *J. Linn. Soc.* **23**: 73 (1886); H. Léveillé in *Bull. Soc. bot. Fr.* **53**: 499 (1906) pro parte, **54**: 590 (1908) pro parte, excl. spec. *Faurie*.; Matsumura & Hayata, *Enum. pl. Formosa*: 41 (1906) pro parte, excl. spec. *Faurie*. anno 1903; Hayata, *Icon. pl. formos.* **1**: 79 (1911); Matsumura, *Index pl. jap.* **2**: 366 (1912) pro parte; R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925) ('*formosum*'); Sasaki, *List. pl. Formos.*: 295 (1928) pro parte excl. syn.; Makino & Nemoto, *Fl. Jap.* 2nd ed.: 748 (1931); Susuki in Masamune, *Short fl. Formosa*: 141 (1936) ('*formosana*'); N. Robson in *Blumea* **20**: 253 (1973), in Li et al., *Fl. Taiwan* **2**: 630 (1976) excl. t. 429. Type: Taiwan. Taipei, 'prope Tamsuy' [Tansui], 1864, *Oldham* 31 (LE, holotype; BM!, K!).

H. patulum sensu Matsumura & Hayata in *J. Coll. Sci. Univ. Tokyo* **22**: 41 (1906) pro parte, quoad spec. cit.; Hayata, *Icon. Pl. Formos.* **1**: 79 (1911) pro parte, quoad loc. Taiwan. cit.; Matsumura, *Index Pl. jap.* **2**: 368 (1912) pro parte, quoad loc. Taiwan cit.

Takasagoya formosana (Maxim.) Y. Kimura in *Bot. Mag. Tokyo* **50**: 499, ff. 1, 3a–i (1936), in Nakai & Honda, *Nova fl. jap.* **10**: 89, ff. 37(1), 38(1), 39(1951).

Icon: Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: f. 39 (1951); Fig. 21.

Shrub c. 22 cm tall, with branches spreading, arching. *Stem* 4-lined and ancipitous when young, soon 2-lined to terete; internodes 1·5–6 mm long, shorter than leaves; bark grey-brown. *Leaves* sessile; lamina 20–60 × 11–29 mm, ovate or elliptic to oblong-elliptic, subacute to rounded, margin plane, base cuneate to rounded, paler beneath, not glaucous, subcoriaceous, lower ones tardily deciduous; venation: 1–2 pairs main laterals (the upper forming intramarginal vein) and 7 pinnate midrib branches, with tertiary reticulum very faint or invisible; laminar gland dots prominent; intramarginal glands dense. *Inflorescence* 1–3-flowered, terminal, and 1–2-flowered on subsidiary branches from up to 7(–10) nodes below; pedicel 5–10 mm long; bracteoles narrowly elliptic, subpersistent. *Flowers* 25–35 mm in diam., stellate to very shallowly cyathiform; buds ± broadly ovoid, subacute to obtuse. *Sepals* 7–10 × 1·5–6 mm, very slightly connate, imbricate, subequal to unequal, erect in bud, ascending in fruit, lanceolate or narrowly elliptic to oblanceolate or elliptic-ovate, acute to subacute, 5–7-veined with veins reticulately branched, midrib distinct but narrow; laminar glands linear and punctiform; inframarginal glands scattered, indistinct. *Petals* golden yellow, not veined or tinged red, spreading with incurved tip, (10–)13–17(–20) × 8–12 mm, *c.* 2 × sepals, obovate, with apiculus short, *Stamen fascicles* each with *c.* 25–40 stamens, longest 8–12 mm long, *c.* 0·7 × petals. *Ovary* 3–4·5 × 3–3·5 mm, ovoid to subglobose; styles (6·5–)7–8(–8·5) mm long, 1·2–2·5 × ovary, slender; stigmatic mass subglobose. *Capsule* 8–9 × 6 mm, broadly ovoid. *Seeds* 0·1–0·2 mm long, ? linear-reticulate. 2n = ?

On well-drained banks or in stony areas; 0–*c.* 500 m.

Taiwan (Taipei). Map 28.

TAIWAN. Taipei: Kelung, 13.v.1903, *Faurie* 114 (BM, E, W); Duan-duan, 18.v.1944, *Masamune* 4560 (TAI).

The long sepals easily distinguish *H. formosanum* from all other species in sect. *Takasagoya* except *H. nakamurai*, which has larger flowers and elliptic to obovate leaves. Its nearest relative in sect. 3. *Ascyreia* appears to be *H. monogynum* forma (iv) 'ovatum', from central China.

2(55). **Hypericum nakamurai** (Masamune) N. Robson

in *Blumea* **20**: 253 (1973), in Li et al., *Fl. Taiwan* **2**: 628 (1976). Type: Taiwan. Hualien, Karen-gun, Karenkyō-tyō, Mt. Seisuizan, *c.* 2000 m, 9.ix.1939, *T. Nakamura* 3734 (TAI!, holotype).

Takasagoya nakamurai Masamune in *Trans. Nat. Hist. Soc. Formosa* **30**: 410 cum fig. (1940); Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 91 (1951).

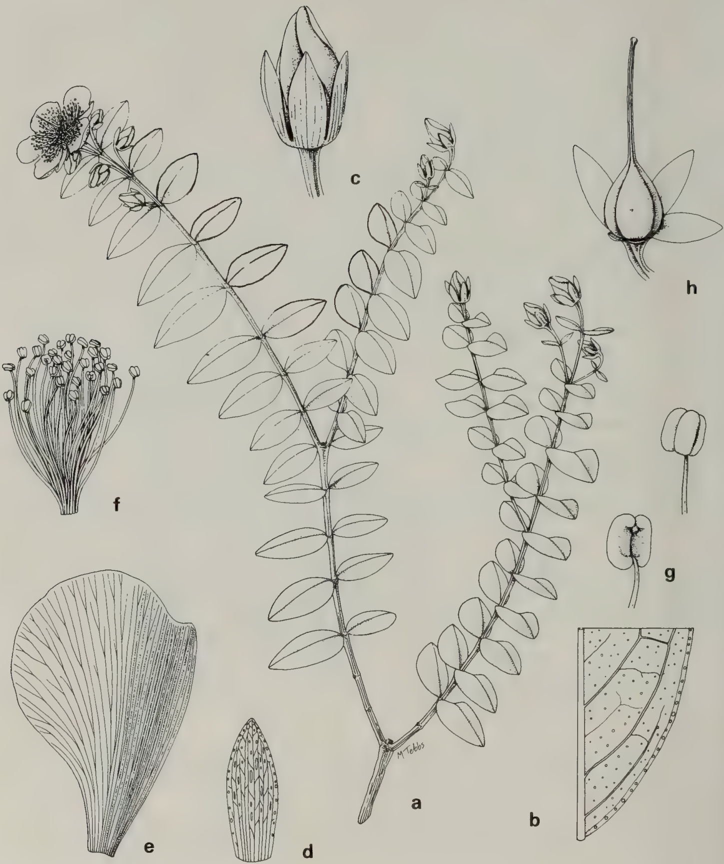
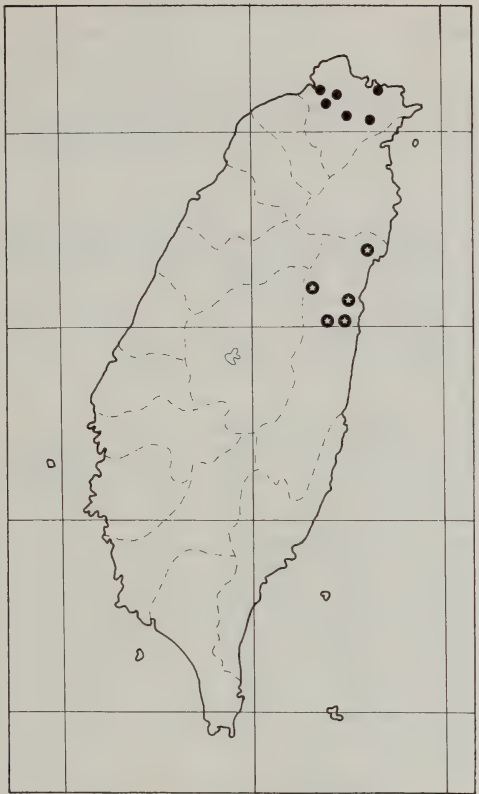


Fig. 21 *H. formosanum*: (a) habit; (b) leaf section; (c) flower bud; (d) sepal; (e) petal; (f) stamen fascicle; (g) anthers; (h) capsule (a × 1; b × 4; c–f, h × 6; g × 20). All *Oldham* s.n.



Map 28 Sect. 4. *Takasagoya*: 1. *H. formosanum* ●, 2. *H. nakamurai* ✪.

Icon: —.

Shrub over 50 cm tall, with branches ± spreading. *Stem* 4-lined and ancipitous when young, soon terete; internodes 6–35 mm long, shorter than to exceeding leaves; bark grey-brown. *Leaves* sessile or subsessile; lamina 10–27(–30) × 5–10(–13) mm, oblong to elliptic or obovate, acute to rounded, margin plane, base cuneate to angustate, paler beneath, not glaucous, subcoriaceous, lower ones tardily ? deciduous; venation: 1 pair main laterals (intramarginal), with *c.* 6 midrib branches, the tertiary reticulum almost invisible; laminar gland dots prominent; intramarginal glands dense. *Inflorescence* 1–3-flowered, terminal, sometimes with 1-flowered short subsidiary branches from up to 3 nodes below; pedicels *c.* 10 mm long; bracteoles narrowly elliptic or elliptic-lanceolate, persistent. *Flowers* 40–60 mm in diam., stellate ?; buds not seen. *Sepals* 3·5–5(–8) × 0·7–1·2(–2) mm, very slightly connate, scarcely imbricate, equal, spreading ? in flower, spreading or reflexed in fruit, linear-lanceolate to linear, subacute to rounded, 5-veined with veins reticulately

branched, midrib indistinct; laminar glands striiform and punctiform; inframarginal glands indistinct or absent. *Petals* bright yellow, not veined or tinged red, spreading ?, 20–28 × 10–20 mm, *c.* 3·5–6 × sepals, obovate, with apiculus short. *Stamen fascicles* each with *c.* 15 stamens, longest 12–16 mm long, *c.* 0·6 × petals. *Ovary* 2·5–3(–5) × *c.* 1·5 mm, narrowly ovoid-ellipsoid; styles 10·5–12(–15) mm long, *c.* 4 × ovary, slender; stigmatic mass capitate. *Capsule* 8–12 × 4–6 mm, cylindric-ellipsoid. *Seeds* dark yellowish-brown, 1·2–1·4 mm long, narrowly cylindric, narrowly carinate with long apical expansion narrow or sometimes narrowly winged, linear-reticulate. 2n = ?

In open limestone rock crevices; 1400–2400 m.

Taiwan (Hualien). Map 28.
TAIWAN. Hualien: Mt. Luanshan to Mt. Patolushan, N.W. of Hualien, 2000–2200 m, 4.viii.1963, *Tamura, Shimizu & Kao* 21707 (E); around Mt. Chingshui, 1800–2400 m, i.v.1961, *Shimizu* 12543 (TAI).

H. nakamurai is closely related to *H. formosanum*, but usually differs in having narrower leaves, smaller, narrower sepals that are reflexed in fruit, larger petals (? always), relatively longer styles and narrower fruits, as well as a distinct geographical and altitudinal distribution. However, a specimen of *H. formosanum* from Mt. Ta Tung, Taipei Co. (*Sasaki* s.n., NTU 077118) is somewhat intermediate.

3(56). **Hypericum senkakuinsulare** Hatusima

in *J. Geobot.* **21**: 2, cum tab. (1973); Y. Kimura in *Asahi hyakka, sekai no shokobutsu* [*Weekly Asahi Encycl., Plants of the World*] (No. 64): 1511 cum tab. (1977). Type: Ryukyu Is., Senkaku Group, Uotori I., 360 m, *S. Tamaki* (URO, holotype).

Icon: Y. Kimura in *Asahi hyakki, sekai no shokobutsu* (No. 64): 1511 (1977).

Shrub c. 0.6 m tall, with branches spreading. *Stem* soon terete; internodes 10–20 mm long, shorter than leaves; bark reddish-brown. *Leaves* sessile; lamina 23–35 × 10–18 mm, elliptic or oblong-elliptic to obovate, rounded, margin plane, base cuneate to cuneate-angustate, not glaucous, chartaceous, deciduous; venation: 1 pair main laterals (intramarginal) and *c.* 5–6 pinnate midrib branches, without visible tertiary reticulum; laminar gland dots numerous; intramarginal glands. *Inflorescence* 1-flowered, terminal, without subsidiary branches; pedicels *c.* 10 mm long; bracteoles elliptic. *Flowers c.* 40 mm in diam., cyathiform; buds narrowly ovoid, subacute. *Sepals c.* 3 × 2 mm, very slightly connate ?, not or scarcely imbricate, subequal, erect in bud, broadly oblong, obtuse; laminar glands linear. *Petals* bright yellow, not veined or tinged red, incurving, *c.* 25 × 18 mm, *c.* 6 × sepals, obovate, very short, apiculus rounded. *Stamen fascicles* each with *c.* 15 stamens, longest *c.* 15 mm long, *c.* 0·7 × petals. *Ovary* with styles 9 mm long, slender. *Capsule c.* 10 mm long, narrowly ovoid. *Seeds* not recorded. 2n = ?

Near rocky summit of mountain; 360 m.

Ryukyu Islands (Senkaku Group). Map 30.
RYUKYU IS. Senkaku Group: Uotori I. (not seen).

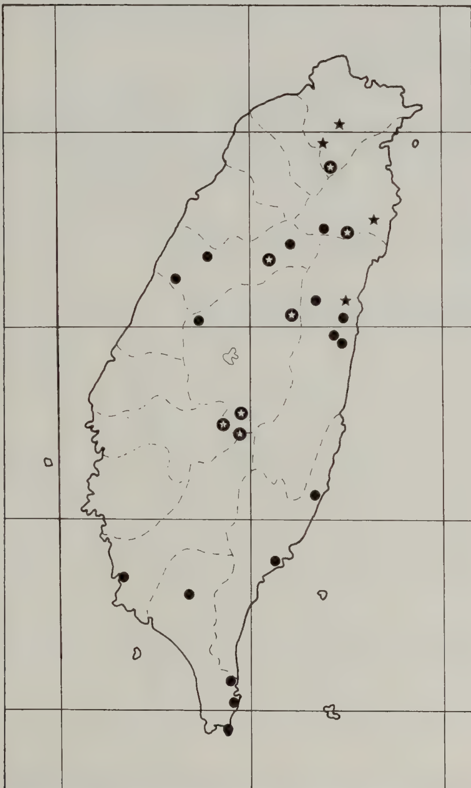
H. senkakuinsulare is known from only the type locality. It is apparently related to *H. formosanum*, the geographically nearest species, but differs in its consistently rounded leaves, its solitary cyathiform flowers with smaller sepals, and (?) its narrower capsules.

4(57). **Hypericum geminiflorum** Hemsley

in *Ann. Bot.* **9**: 44 (1895); Henry in *Trans. Asiat. Soc. Japan* **24**, suppl. 1: 19 (1896); Matsumura & Hayata, *Enum. pl. Formosa*: 41 (1906); H. Léveillé in *Bull. Soc. bot. Fr.* **54**: 590 (1908); Hayata, *Icon. pl. formos.* **1**: 76 (1911), **3**: 41 (1913); Matsumura, *Index Pl. Jap.* **2**: 366 (1912); Makino & Nemoto, *Fl. Japan* ed. 2: 748 (1931); N. Robson in *Blumea* **20**: 253 (1973), in *Fl. Malesiana* I, **8**: 19 (1974), in Li

et al., *Fl. Taiwan* **2**: 630 (1976). Type: Taiwan, Prov. Takao [Kaohsiung], Apes' Hill, *Henry* 1155 (K!, holotype).

Shrub 0·3–1·5 m tall, lax, with branches erect to ascending or pendulous. *Stem* 4-lined and ancipitous when young, eventually 2-lined to terete; internodes 9–35 mm long, shorter than leaves. *Leaves* subsessile; lamina 18–45 × 6–22 mm, oblong or oblong-lanceolate to elliptic or ovate, acute to obtuse or rounded-apiculate, margin incrassate, base broadly to narrowly cuneate, paler beneath, not glaucous, chartaceous, lower ones tardily deciduous; venation: 1–2 pairs main laterals (the upper sometimes forming distinct intramarginal vein) and *c.* 4–9 pinnate midrib branches, with tertiary reticulum faint or invisible; laminar gland dots sometimes prominent above; intramarginal glands dense. *Inflorescence* 1–(2–3) flowered, terminal and on solitary or paired short subsidiary branches from up to 14 nodes below: pedicels 3–4 mm long; bracteoles reduced, deciduous. *Flowers* 20–30 mm in diam., stellate; buds ovoid, acute to obtuse. *Sepals* (1–)1·5–3·5 × 1–2·5 mm, free or slightly connate,



Map 29 Sect. 4. *Takasagoya*: 4a. *H. geminiflorum* subsp. *geminiflorum* ● (part; see also Map 30), 4b. *H. geminiflorum* subsp. *simplicistylum* ✪, 5. *H. subalatum* ★.

imbricate, equal or subequal, broadly ovate to oblong or subcircular, subacute to rounded, 1–5-veined with veins unbranched, midrib not distinct; laminar glands mostly linear. *Petals* bright yellow or rarely white, not veined or tinged red, spreading, 9–15 × 5–7 mm, 4–9 × sepals, obovate, apiculus obsolete or absent. *Stamen fascicles* each with 5–11 stamens, longest 6–10 mm long, *c.* 0·65 × petals. *Ovary* 2·5–5 × 1·5–2·5 mm, ± narrowly ellipsoid; styles 3·5–6(–7) mm long, 1–2 × ovary, ± slender; stigmatic mass capitate to ellipsoid or cylindric. *Capsule* 5–11 × 3–5·5 mm, narrowly cylindric to cylindric-ellipsoid or narrowly cylindric-conic. *Seeds* dark reddish-brown, 0·6–1·5 mm long, narrowly cylindric or narrowly ellipsoid to fusiform, narrowly carinate with ± long apical expansions or unilaterally ± deeply winged, very shallowly linear-reticulate. 2n = ?

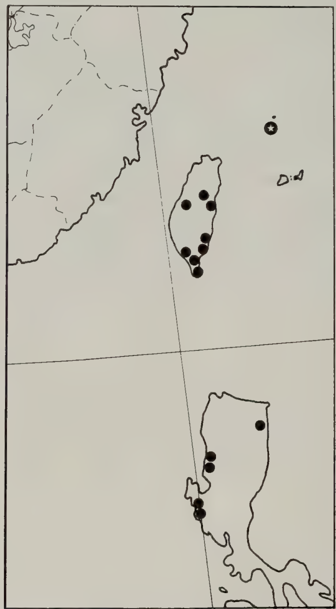
Open or exposed stony ground; 1000–1800 m.

Taiwan, Philippines (Luzon). Maps 29, 30.

H. geminiflorum comprises two subspecies (treated as varieties by Robson, 1973, supra cit.), one found at relatively low altitudes in south-east Taiwan and Luzon (subsp. *geminiflorum*), the other at higher altitudes in central and north-west Taiwan (subsp. *simplicistylum*).

4a(57a). **H. geminiflorum** subsp. **geminiflorum**

H. trinervium Hemsley in *Ann. Bot.* **9**: 144 (1895); Henry in *Trans. Asiat. Soc. Japan* **24**: suppl. 1: 19 (1896); Matsumura & Hayata, *Enum. pl. Formosa*: 43 (1906); H.



Map 30 Sect. 4. *Takasagoya*: 3. *H. senkakuinsulare* ✪, 4a. *H. geminiflorum* subsp. *geminiflorum* ● (see also Map 29).

Léveillé in *Bull. Soc. bot. Fr.* **54**: 590 (1908); Hayata, *Icon. pl. formos.* **1**: 79 (1911); Matsumura, *Index pl. jap.* **2**: 369 (1912); Sasaki, *List pl. Formosa*: 296 (1928). Type: Taiwan, Prov. Takao [Kaohsiung], South Cape, *Schmürer* in *Henry* 906 (K!, lectotype–mihi), 906A (K!, syntype).

H. loheri Merrill in *Philipp. J. Sci.* C, **4**: 294 (1909). Type: Philippines, Luzon. Benguet Prov., Ambuklao [Ambuelo (US)], *Loher* 66 (K!, lectotype–mihi; US!); Benguet Prov. Mt. Ugo, xii.1908, *Ramos* in PBS 5716 (US! syntype); Zambales [Pampanga] Prov., Mt. Pinatubo, iv.1907, *Foxworthy* in PBS 2562 (BO!, US!, syntypes).

H. acutisepalum Hayata in *J. Coll. Sci. Tokyo* **30** (1): 38 (1911), *Icon. pl. formos.* **1**: 77, t. 15 (1911); Ito, *Ill. formos. pls*: 363 (1927); Makino & Nemoto, *Fl. Japan* 2nd ed.: 747 (1931); Liu, *Ill. nat. introd. lign. pl. Taiwan* **1**: 306, f. 254 (1960); *Iconogr. cormophyt. sin.* **2**: 874, f. 3478 (1972). Type: Taiwan: Prov. Taityû [Taitung], Nantô, vii.1907, *Kawakami* 3245 (TI!, holotype).

H. formosanum sensu Hayata, *Suppl. icon. pl. formos.* **6**: 7 (1916); N. Robson in Li et al., *Fl. Taiwan* **2**: 63D (1976) pro parte, quoad t. 429.

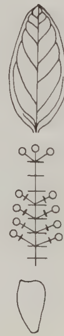
?*H. pustulosum* R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 176 (1925), nomen.

H. lackeyi Elmer in *Leafl. Philipp. bot.* **9**: 3190 (1934). Type: Philippines, Luzon. Pampanga Prov., Zambales Mts, Mt. Pinatubo, Camp Stotsenburg, *Elmer* 21989 (PNH!, holotype; BM!, BO!, GH!, K!, L!, PNH!, SING!, Z!).

Takasagoya acutisepala (Hayata) Y. Kimura in *Bot. Mag., Tokyo* **50**: 501, f. 3j–o (1936), in Nakai & Honda, *Nova fl. jap.* **10**: 92, ff. 37–2, 38–3, (1951).

T. geminiflora (Hemsley) Y. Kimura in *Bot. Mag. Tokyo* **50**: 501 ff. 2, 4 j–n (1936), in Nakai & Honda, *Nova fl. jap.* **10**: 92, ff. 37–5, 38–4, 40 (1951).

T. trinervia (Hemsley) Y. Kimura in *Bot. Mag., Tokyo* **50**: 503, (1936), in Nakai & Honda, *Nova fl. jap.* **10**: 95, f. 38–6 (1951).



Icones: N. Robson in Li *et al.*, *Fl. Taiwan* **2**: 631, t. 429 (1976); Ho, *Trop. pls. Taiwan in colour* **3**: 114, t. 1 (1982).

Shrub 0·5–1·5 m tall, with branches often spreading and pendulous. *Sepals* 1–2·5 mm long, broadly ovate or triangular-ovate or subcircular to oblong-lanceolate. *Ovary* 2·5–3·5 mm long; styles 4–6(–7) mm long, 1·3–2 × ovary. *Capsule* narrowly cylindric to narrowly cylindric-conic.

Open stony ground; 300–1200 m (Taiwan), 1000–1500 m (Luzon).

Taiwan (Kaohsiung, Pintung, Taitung, Hualien, Ilan), Philippines (Luzon). Maps 29, 30.

TAIWAN. Kaohsiung: Apes' Hill, pre v.1894, *Henry* 1155 (K). Pintung: Kaoshihfo [Kusukusu], 28.vi.1912, *Hayata & Sasaki* (TI). Taitung: Taichung, Sung-mao, 15.x.1970, *Kuoh, Chuma & Chang* 8761 (H). Hualien: from Patakang to Tienhsiang, 28.xii.1960, *Shimizu & Kao* 10644 (TAI). Ilan; vicinity of Nan-shan, 1200 m, 26.ix.1964, *Koyama* 24056 (E).

PHILIPPINES. Luzon. Cagayan Prov.: Peñablanca, iii–v.1929, *Ramos* PBS 76892 (K.) Benguet Prov.: Mangayan to Baguio, x.1921, *Ramos & Edaño* PBS 40501 (A, BO, K, US). Pampanga Prov.: Zambales Mts, Mt. Pinatubo, Camp Stotsenburg, v.1927, *Elmer* 21989 (BM, BO, GH, K, L, PNH, SING, Z).

H. trinervium, at first glance, seems rather distinct from *H. geminiflorum* in its stouter shoots and pedicels and relatively broad leaves with a strong submarginal vein. These characters, however, occur sporadically in other individuals of *H. geminiflorum*, and so *H. trinervium* appears to be no more than a local race from the extreme south of Taiwan.

Forms with white flowers have been recorded in both Taiwan (*Kawakami, Shimada & Ito* 28.iv.1917) and the Philippines (cf. description of *H. loheri*).

4b(57b). **H. geminiflorum** subsp. **simplicistylum** (Hayata) N. Robson, **stat. nov.**

H. simplicistylum Hayata in *J. Coll. Sci. Tokyo* **30** (1): 40 (1911), *Icon. pl. formos.* **1**:

79, t. 16 (1911); Makino & Nemoto, *Fl. Japan* 2nd ed.: 752 (1931); Suzuki in Masamune, *Short fl. Formosa*: 141 (1936). Type: Taiwan. Nôkôzan, ad 1800 m alt., vi.1908, *Kawakami & Mori* 4507 (TI!, holotype).

H. formosanum sensu Suzuki in *Ann. Rep. bot. Taihoku Gdns* **1**: 158 (1931) pro parte, quoad spec. *Suzuki* 6375.

Takasagoya simplicistyla (Hayata) Y. Kimura in *Bot. Mag., Tokyo* **50**: 502, ff. 3 r–s, 4 f–i, in Nakai & Honda, *Nova fl. jap.* **10**: 93, ff. 37–4, 38–5 (1951).

H. geminiflorum var. *simplicistylum* (Hayata) N. Robson in *Blumea* **20**: 254 (1973), in Li et al., *Fl. Taiwan* **2**: 632 (1976).

Icon: Hayata, *Icon. pl. formos.* **1**: 79, t. 16 (1911).

Shrub c. 0·3–0·4 m tall, with branches erect or ascending. *Sepals* 2·5–3 mm long, broadly ovate to oblong. *Ovary* 4–4·3 mm long; styles 3·5–5 mm long, 1–1·3(–1·5) × ovary. *Capsule* cylindric to cylindric-ellipsoid.

Exposed stony ground (mountain slopes, roadsides); 1500–1800 m.

Taiwan (Taipei, Ilan, Taichung, Nantou, Chiayi). Map 29.

TAIWAN. Taipei: Raisya, 1.vii.1916, *Matuda* 1333 (TAI). Ilan: Inter Kinyan et Piyahau, 24.ix.1930, *Suzuki* 6375 (TAI). Taichung: Lakulaku, 14.xii.1923, *Sasaki* s.n. (TAI). Nantou: Nengkaoshan, Tung-yen to Yin-hai, 11.viii.1971, *Huang, Hsien & Kao* 5677 (TAI). Chiayi: Nütakayama. viii.1935, *Sasaki* s.n. (TAI).

Subsp. *simplicistylum* is apparently an upland derivative of subsp. *geminiflorum*. Although it tends to be smaller in all parts and more erect, there is a certain overlap in character variation between it and the more lowland taxon that prevents their recognition as separate species. The relative style length and fruit shape, however, are usually diagnostic. This variation, when considered along with the distinct geographical and altitudinal distributions of the two taxa, suggests that their appropriate rank is subspecies rather than variety.

5(58). **Hypericum subalatum** Hayata

in *J. Coll. Sci. Univ. Tokyo* **30**: 41 (1911), *Icon. pl. formos.* **1**: 77 (1911); Makino & Nemoto, *Fl. Jap.* 2nd ed.: 752 (1931); Suzuki in Masamune, *Short fl. Formosa*: 141 (1936); N. Robson in *Blumea* **20**: 253 (1973), in Li et al., *Fl. Taiwan* **2**: 643 (1976). Type: Taiwan, Prov. Taihoku [Taipei], Kussyaku, secus rivulos, 8.vi.1903, *Faurie* 115 (TI!, holotype; BM!, E!, W!).

H. formosanum sensu H. Léveillé in *Bull. Soc. bot. Fr.* **53**: 499 (1906) pro parte; Matsumura & Hayata, *Enum. pl. Formosa*: 41 (1906) pro parte; H. Léveillé, op. cit. **54**: 590 (1908) pro parte, omnes quoad *Faurie* 115.

H. kushakuense R. Keller in *Bot. Jahrb.* **58**: 191 (1923). Type: Taiwan, Kushaku, *Faurie* 115 (B†, holotype; BM!, E!, TI!, W!).

Takasagoya subalata (Hayata) Y. Kimura in *Bot. Mag., Tokyo* **50**: 500, f. 3 p–q (1936), in Nakai & Honda, *Nova fl. jap.* **10**: 91, ff. 37 (6), 38 (2) (1951).

Icon: —.

Shrub over 50 cm tall, with branches ± ascending. *Stem* persistently 4-angled to narrowly 4-winged; internodes 10–25 mm long, shorter than leaves; bark reddish-brown. *Leaves* sessile; lamina 19–70 × 5–16 mm, narrowly elliptic to lanceolate or narrowly oblong-elliptic, acute to subacute or rounded-apiculate, margin plane, base cuneate, paler beneath, not glaucous, chartaceous, lower ones tardily deciduous; venation: 2–3 pairs main laterals (sometimes forming distinct intramarginal vein) and 6–7 pinnate midrib branches, with tertiary reticulum faint or almost invisible; laminar gland dots prominent; intramarginal glands dense. *Inflorescence* 1-flowered, terminal and on short subsidiary branches from up to *c.* 6 nodes below; pedicel 6–12 mm long; bracteoles foliar to subulate, deciduous. *Flowers c.* 25 mm in diam., substellate; buds ovoid, acute. *Sepals* 5–8 × 1–2(–3) mm, free or almost so, imbricate, subequal to unequal, erect in bud and fruit, oblong-linear to elliptic or oblanceolate, subacute to acute or shortly acuminate, 7–9-veined with veins little branched, midrib ± obscure; laminar glands mostly linear. *Petals* bright yellow,

tinged red, ± spreading, *c.* 10–12 × 6 mm, 1·5–2 × sepals, obovate, with apiculus obsolete. *Stamen fascicles* each with *c.* 15 stamens, longest *c.* 9–10 mm long, *c.* 0·8 × petals. *Ovary* 2–4 × *c.* 0·7–1·3 mm, ± narrowly ovoid; styles (3·3–)4–7 mm long, *c.* 2–2·5 × ovary, slender; stigmatic mass capitate. *Capsule* 7–9 × 3–4 mm, narrowly ovoid to cylindric. *Seeds* dark yellowish-brown, 0·9–1·1 mm long, narrowly cylindric or narrowly ovoid-cylindric, scarcely carinate with long narrow apical expansion, very shallowly linear-reticulate. 2n = ?.

In open limestone rock crevices; 400–900 m.

Taiwan (Taipei, Ilan, Hualien). Map 29.

TAIWAN. Taipei: Hsintien, i.1914, *Faurie* 1067 (BM, G). Ilan: Heirinbi district, Kueishan I., 28.iii.1912, *Price* 294 (K). Hualien: Shuiyan to Luanshan, NW. of Hualien, 700–900 m, 21.viii.1963, *Tamura, Shimizu & Kao* 21508 (E).

The 4-angled mature stem distinguishes *H. subalatum* from all other species in sect. *Takasagoya*.

Sect. 5. **ANDROSAEMUM** (Duhamel) Godron

in Grenier & Godron, *Fl. France* **1**: 320 (1847).

Shrubs 0·3–2 m tall, deciduous, glabrous, without dark glands; branching lateral. *Stems* 2–4-lined (subfoliar lines less prominent or absent) and ± ancipitous when young, eventually terete, eglandular; cortex exfoliating in strips; bark smooth, scaling or fissured. *Leaves* opposite, decussate, sessile to shortly petiolate, free, deciduous at basal articulation; lamina entire, with venation pinnate, partially (or rarely completely ?) closed, the tertiary densely reticulate; laminar glands punctiform, pale; marginal gland dots pale; ventral glands absent. *Inflorescence* (1–)3–*c.* 20-flowered, branching dichasial to monochasial from 1–2 nodes, sometimes with subsidiary branches; bracts and bracteoles foliar (persistent) or reduced (deciduous), not sepaline. *Flowers* stellate, homostylous. *Sepals* 5, free, persistent or deciduous, with margin entire; veins 5–11; laminar glands pale, linear to punctiform; inframarginal glands pale. *Petals* 5, deciduous, with apiculus present, subterminal, small, or absent, and margin entire; marginal glands absent; laminar glands ± numerous, pale, linear, distally interrupted. *Stamen fascicles* 5, free, deciduous, each with 20–40 stamens; filaments united very shortly; anther gland amber; pollen types III–IV. *Ovary* with 3 (abnormally 5) incompletely axile placentae (parietal in upper *c.* 2/3), ∞-ovulate; styles 3 (abnormally 5), free; stigma subcapitate to narrowly capitate. *Capsule* 3 (abnormally 5)-valved, coriaceous to chartaceous and completely to partially dehiscent or ± thin-walled, fleshy and tardily dehiscent or indehiscent, narrowly vittate. *Seeds* cylindric, broadly carinate to partially or completely unilaterally winged, with apical expansions sometimes wing-like; testa linear-reticulate.

Basic chromosome number (x): 10; ploidy 4.

Habitat: evergreen forest and dry open areas (Sp. 1); damp, shaded places (other species); *c.* 200–2100 m.

Distribution: Macaronesia, NW. Africa, W. & S. Europe, W. Mediterranean islands, Crete, S. Aegean islands, Turkey, Transcaucasia, N. Iran, Turkmenistan, Cyprus, Levant south to N. Israel, SW. Saudi Arabia.

4 species (+ 1 hybrid).

Key to sect. 5. *Androsaemum*

1 Sepals shrivelling and deciduous before fruit ripens; styles 3–5 × ovary; leaves (when crushed) usually smelling of goats (4. ***hircinum***) 2
Sepals persistent at least until fruit ripens; styles 0·5–3 × ovary; leaves (when crushed) very rarely (Sp. 3a in part) smelling of goats 6

2(1) Styles 10–13 mm long; flowers 20–30 mm in diam. (petals 10–15 mm long); leaves lanceolate to triangular-lanceolate .... 4b. ***hircinum*** subsp. ***cambessedesii*** (p. 311)
Styles 14–24 mm long or, if 12–13 mm long, then flowers 30–40 mm in diam. (petals 15–21 mm long); leaves various 3

3(2) Capsule (8)9–14 mm long; leaves narrowly ovate to narrowly lanceolate or triangular-lanceolate, mostly acute to obtuse 4
Capsule 6–8(9) mm long; leaves broadly ovate to ovate-lanceolate, mostly obtuse to rounded.. 5

4(3) Branches erect; leaves goat-scented when crushed .... 4a. ***hircinum*** subsp. ***majus*** (p. 310)
Branches spreading or pendent; leaves not goat-scented .... 4d. ***hircinum*** subsp. ***metroi*** (p. 312)

5(3) Petals 15–18 mm long; leaves with apex obtuse to rounded, base rounded to truncate, margin plane .... 4c. ***hircinum*** subsp. ***hircinum*** (p. 312)
Petals 18–20 mm long; leaves with apex apiculate or rounded, base cordate to rounded or shortly angustate, margin usually ± crisped-undulate 4e. ***hircinum*** subsp. ***albimontanum*** (p. 313)

6(1) Styles *c.* 0·5 × ovary; petals equalling or shorter than sepals; ripe fruit fleshy, dark-brown to black, lucent, indehiscent .... 3. ***androsaemum*** (p. 301)
Styles 1–3 × as long as ovary; petals 1·5–4 × sepals; ripe fruit dry, not usually lucent, dehiscent 7

7(6) Petals *c.* 1·5–2 × sepals; fruit coloured bright red during maturation, dehiscing tardily and incompletely; outer sepals ± broadly ovate .... 3x. x ***inodorum*** (p. 304)
Petals 3–4 × sepals; fruit not coloured bright red during maturation, dehiscing completely; outer sepals ± narrowly oblong or ± narrowly elliptic.. 8

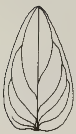
8(7) Inflorescence branches widely spreading; capsule coriaceous, ovoid-ellipsoid to ellipsoid; leaves broadly triangular-ovate to oblong-ovate; petals (16)18–22 mm long 1. ***grandifolium*** (p. 298)
Inflorescence branches ± narrowly ascending; capsule chartaceous, ± broadly cylindric-ellipsoid; leaves ± narrowly ovate to triangular-lanceolate; petals 10–18 mm 2. ***foliosum*** (p. 300)

1(59). **Hypericum grandifolium** Choisy

Prodr. monogr. fam. Hypéric.: 38, t. 3 (1821), in DC., *Prodr. syst. nat. regni veg.* **1**: 544 (1824); Cham. & Schlecht. in *Linnaea* **3**: 120 (1828); Lowe, *Fl. Madeira*: 75 (1868); Menezes, *Fl. archip. Madeira*: 28 (1914); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 177 (1925); Stefanoff in *God. Agr.-les. Fak. Univ. Soflya* **11**: 144 (1933), **12**: 82 (1934); in *Pflanzenreale* **4**: Karte 2a (1933); Schaeffer, *Pl. Canary Islands*: 144 + photo (1963), *Pfl. Kanar. Inseln,* 2nd ed.: 148 + photo (1967); Kunkel, G., *Endemismos Canarios*: 295 (1977); Kunkel, G. & M. A., *Fl. Gran Canaria* **4**: 42, t. 164 (1979). Type: Canary Islands. 'In insula Tenerife', 1806, *Chr. Smith* (G-DC!, lectotype–mihi); 'in insula Tenerife', 1807, *Broussonet* (G-DC!, syntype).

H. erectum Solander ex R. Br. [in Buch] in *Abhandl. Physik. Kl. Königl. Preuss. Akad. Wiss. Berlin* **1816–17**: 75 (1819) in synon., non Thunb. ex Murray (1784).
H. canariense Brouss. ex Webb & Berth., *Phyt. Canar.* **1**: 51 (1836) in synon, non L. (1753).
Androsaemum webbianum Spach, *Hist. nat. vég.* Phan. **5**: 418 (1836), in *Ann. Sci. nat.* (Bot.) II, **5**: 362 (1836); Webb & Berth., *Phyt. Canar.* **1**: 51 (1836), ibid., t. 4E (1841); Pitard & Proust, *Les Iles Canaries*: 134 (1909). Type as for *Hypericum grandifolium* Choisy.
H. grandiflorum sensu Ceballos & Ortuña, *Veg. Fl. for. Canar. occid.*: 388 t. 158 (1951) et auct., non Salisb. (1798) nec. hort.
H. elatum sensu Plaisted & Lighty in *Nat. Hort. Mag.* **38**: 131 (1959); Lid in *Skr. Norske Videns. -Akad. Oslo, Math. -Nat. Kl.* II, **23**: 120 (1967) et auct. plur.

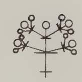
Icon: Kunkel, G. & M. A., *Fl. Gran Canaria* **4**: t. 164 (1979).



Shrub 0·5–1·8(–2?) m tall, bushy, with branches erect or ascending. *Stems* 4-lined and ancipitous when young, soon 2-lined, eventually terete; internodes 2–4 mm long, shorter than leaves; bark scaling. *Leaves* sessile, ± amplexicaul; lamina (30–)40–90 × (20–)25–45 mm, broadly triangular-ovate to oblong-ovate, obtuse (or rarely acute) to rounded, margin plane, base cordate to rounded, not paler beneath, not glaucous, papyraceous; venation: 4–5 pairs main laterals, with tertiary reticulum prominent above; laminar glands small; intramarginal glands dense. *Inflorescence* 1–13-flowered, from 1–2 nodes with internode not condensed, broadly pyramidal to subcorymbiform with branches widely spreading, occasionally with accessory flow-

Note: The petals in text figures appearing on pp. 298–309 are approximately natural size and the leaves half natural size.

ers, sometimes with flowering branches from up to 4 nodes below, the whole then cylindric; pedicels 5–11 mm long; bracts foliar or reduced and linear to linear-subulate. *Flowers* (25–)30–45 mm in diam.; buds ellipsoid-subglobose, obtuse to rounded. *Sepals* 6–8 × 2–3 mm, imbricate, unequal to subequal, spreading to reflexed and enlarging after anthesis, erect and persistent in fruit, lanceolate to narrowly oblong, acute to subacute, 7–9-veined from base with veins ± branched and reticulate, midrib distinct; laminar glands linear and punctiform; inframarginal glands dense. *Petals* golden yellow, not tinged red, spreading, (16–)18–22 × (4–)6–8 mm, 3–4 × sepals, narrowly oblong-lanceolate, with apiculus obtuse or absent. *Stamen fascicles* each with (25–)30–40 stamens, longest 15–20 mm long, *c.* 0·9 × petals. *Ovary* 4–5(–6) × (2·5–)3–3·5 mm, narrowly ovoid to ovoid-ellipsoid, acute; styles (rarely 5 in number) (7·5–)9·5–13(–17) mm, 2–3 × ovary, erect, narrowly divergent towards apex, slender; stigma narrowly capitate. *Capsule* 8–13 × 6–8 mm, ovoid-ellipsoid to ellipsoid, acute, coriaceous, completely dehiscent. *Seeds* yellowish-brown, *c.* 1·2 mm long, broadly carinate or with narrow unilateral wing, almost without terminal appendages. 2n = 40.



In evergreen *Laurus* forest and on dry stony hillsides and cliffs; 200–1500 m (Canaries), 400–500 m (Madeira).

Canary Islands (all islands), Madeira. Map 31.

CANARY IS. La Palma: Breña Alta to El Paso road, E. end of Cumbre tunnel, 1000 m, 21.iv.1977, *Jarvis, Gibby & Humphries* 411 (BM). Gomera: Monte del Cedre, top of Barranco del Hermingua, 900 m, 8.v.1977, *Jarvis* 605 (BM). Tenerife: Monte de la Mercedes, Mirador, 4 km W. of Pico del Ingles, 800 m, 29.iv.1977, *Jarvis* 451 (BM). Gran Canaria: Los Lagunetas, 26.vi.1931, *Frey & Storå* s.n. (H). Also in

Map 31 Sect. 5. *Androsaemum*: 1. *H. grandifolium* ☆, ★ (records), 4a. *H. hircinum* subsp. *majus* ●, ○ (naturalised), 4b. *H. hircinum* subsp. *cambessedesii* ■, 4c. *H. hircinum* subsp. *hircinum* ▲, 4d. *H. hircinum* subsp. *metroi* ⏶, 4e. *H. hircinum* subsp. *albimontanum* □.

Hierro, Fuerteventura and Lanzarote, *fide* Hansen & Sunding, *Fl. Macaron. Checkl.*: 51 (1979).

MADEIRA. São Vicente valley, 28.vii.1954, *Moore* s.n. (BM); near Curral das Freiras, 12.vii.1974, *McClintock* s.n. (BM); Queimadas, 880 m, 26.vi.1957, *Malberg* s.n. (H).

H. grandifolium does not show any marked geographical variation. Among the species of sect. *Androsaemum* with persistent sepals, it can be distinguished by its relatively lax inflorescence, relatively large flowers and completely dehiscent capsules. It has frequently been confused with *H. elatum* Aiton (= 3x. *H.* x *inodorum* Miller, q.v.).

2(60). **Hypericum foliosum** Aiton

Hort. kew. **3**: 104 (1789); Choisy, *Prodr. monogr. fam. Hypéric.*: 46 (1821), in DC., *Prodr. syst. nat. veg.* **1**: 544 (1824); Watson in Godman, *Nat. hist. Azores or W. Islands*: 142 (1870), in Trelease in *Anns. Rep. Mo. botl. Gdn* **8**: 99 (1897); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 177, f. 73M, N (1925); Stefanoff in *God. Agr.-les. Fak. Univ. Sofiya* **11**: 144 (1935), **12**: 82 (1934), in *Pflanzenareale* **4**; karte 2a (1933); Palhinha, *Cat. pl. vasc. Açores*: 74 (1966); N. Robson in *Flora europaea* **2**: 263 (1968); non *H. foliosum* sensu Jacq., *Hort. Schoenbrun.* **3**: t. 299 (1798) (= *H. prolificum* L.) nec Brouss. ex Webb & Berth., *Phyt. Canar.* **1**: 45 (1836) in synon. (= *H. reflexum* L.f.). Type: Azores. San Miguel, 1777, *Masson* (BM!, holotype).

Icon: Trelease in *Ann. Rep. Mo. botl Gdn* **8**: t. 19 (1897).

Shrub 0·5–1 m tall (or taller ?), bushy (?) with branches erect or ± spreading. *Stems* 4-lined and ancipitous when young, soon 2-lined, eventually terete; internodes 1–3 mm long, shorter than leaves; bark fissuring. *Leaves* sessile or subsessile, sometimes amplexicaul; lamina 35–60 × 10–32 mm, ± narrowly ovate to triangular-lanceolate, obtuse (or rarely acute) to rounded, margin plane, base rounded or more rarely cordate, slightly paler beneath, not glaucous, papyraceous; venation: 4–5 pairs ascending main lateral veins, with tertiary reticulum prominent on both sides; laminar glands small; intramarginal glands dense. *Inflorescence* 1–9-flowered, from 1–2 nodes with condensed internode, subcorymbiform to pseudo-umbellate with branches ± narrowly ascending, without accessory flowers, sometimes with 1–3-flowered branches from node below; pedicels 7–12 mm long; bracts reduced, linear-lanceolate to linear-subulate. *Flowers* (20–)25–30(–35) mm in diam.; buds ellipsoid-subglobose, rounded. *Sepals* (2–)3–6(–7) × 1·5–2·5(–4) mm, imbricate, unequal to subequal, spreading to subdeflexed and enlarging after anthesis, deflexed and persistent in fruit, triangular-lanceolate or lanceolate to oblong-elliptic, acute to obtuse, 5–7-veined from base with veins sometimes ± branched and reticulate; laminar glands linear and punctiform; inframarginal glands dense. *Petals* golden yellow, not red-tinged, spreading, (10–)12–18 × 5–8 mm, 3–4 × sepals, oblanceolate, with apiculus rounded or obsolete. *Stamen fascicles* each with 20–30 stamens, longest 12–18 mm, equalling or slightly exceeding petals. *Ovary* 4–5(–6) × 3–4·5(–5) mm, broadly ovoid to subglobose, acute to obtuse; styles 5–10 mm long, 1·5–2·5 × ovary, erect to suberect, narrowly divergent near apex, slender; stigmas narrowly capitate. *Capsule* 8–13 × 7–10 mm, ± broadly cylindric-ellipsoid, acute to obtuse, chartaceous, somewhat fleshy at first, soon drying, tardily and sometimes incompletely dehiscent. *Seeds* yellowish-brown, 1·2–1·5 mm long, unilaterally winged with terminal winged appendages. 2n = ?

In damp shaded placed in the mountains, 220–800 m.

Azores (all islands). Map 32.

AZORES. Santa Maria: Feiteiras, 220 m, 1.v.1972, *Gonçalves* 3909 (BM). São Miguel: no precise locality, v.1956, *Pickering* 126 (BM). Terceira: Santa Barbara, Caminho Flora, 900 m, 12.vii.1971, *Gonçalves* 3236 (BM). Sâo Jorge: Santo Antonio, 520 m, 4.ix.1971, *Gonçalves* 3472 (BM). Pico: Landroal, 800 m, 27.vii.1971, *Gonçalves* 3304 (BM). Graciosa: No precise locality, 1868 ?, *Drouet*

(BM). Faial: no precise locality, vii.1842, *Watson* s.n. (E, K). Flores: Ribeira Barqueiros, 5.vi.1938, *Storå* s.n. (H). Corvo: Estrada do Farol, 250 m, 9.vi.1971, *Gonçalves* 2645 (BM).

H. foliosum is intermediate in most respects between *H. grandifolium* and *H. androsaemum* except for the leaves, which are frequently narrower than those of both these species. It differs from *H. grandifolium* in its more condensed inflorescence with smaller flowers, usually shorter styles and thinner capsule valves.

3 (61). **Hypericum androsaemum** L.

Sp. pl.: 784 (1753); Reichenb., *Ic. fl. german.* **6**: t. 352 (1844), Syme, *Eng. bot.* 3rd ed.: t. 264 (1865); Boiss., *Fl. orient.* **1**: 788 (1867); Willk. & Lange, *Prodr. fl. hisp.* **3**: 588 (1878); Fiori, *Nuova Fl. ital.* **1**: 520 (1923); Hayek, *Prodr. fl. pen. balc.* **1**: 530 (1925); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 177 (1925); Stefanoff in *God. Agr.-les. Fak. Univ. Sofiya,* **10**: r. 1 f. 2, t. 2 f. 4, t. 3 f. 4 (1932), **11**: 141 (1933), **12**: 81 (1934), in *Pflanzenareale* **4**: karte 1b (1933); Guinea Lopez, *Viscaya y su Paisaje vegetale*: 215 × map (1949); Gorshkova in *Fl. U.R.S.S.* **15**: 214, t. 9 f. 4 (1949); Ross-Craig, *Drawings Br. Pls* **6**: t. 6 (1952); Grossheim, *Fl. Kavkasa* 2nd ed. **6**: 166, t. 30 f. 2, karte 181 (1962); N. Robson in *Fl. Turkey* **2**: 366, ff. 11, 13, map 21 (1967), in *Fl. europaea* **2**: 263 (1968), in *Fl. iranica* **49**: 5 (1968), in Green, *Plants wild & cult.*: 80 (1973); Jordanov & Kožhukharov in Jordanov, *Fl. R.P. Bulg.* **4**: 230, t. 43 f. 1 (1970); Franco, *Fl. Portugal*: 449 (1971); Stjepanovikh-Veselichikh in Josifović, *Fl. Srbije* **3**: 107, t. 31 f. 1 (1972); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 407 (1973); Zangeri, *Fl. italica* **1**: 394 (1976); Fournier, *Quartres flores de France* 2nd ed.: 456 (1977); Bouchard, *Fl. pratique de Corse,* ed. 3: 176 (1977); van Rompaey & Delvosalle, *Atlas fl. belg. lux.* ed. 2: t. 417 (1979). Type: cultivated, *Hort. cliff.* 380 (BM!, lectotype) – see discussion below (p. 000).

H. bacciferum Lam., *Fl. franç.* **3**: 151 (1778); St. Lager in Cariot, *Études des fleures* 8th ed. **2**: 140 (1889); nom. illegit. Type as for *H. androsaemum.*

Androsaemum officinale All., *Fl. pedem.* **3**: 147 (1785); Choisy, *Prodr. monogr. fam. Hypéric.*: 37 (1821), in DC., *Prodr. syst. nat. regni veg.* **1**: 543 (1824); Spach, *Hist. nat. vég.* Phan. **5**: 415 (1836), in *Annls Sci. nat.* (Bot.) II, **5**: 361 (1836); Rouy & Foucaud, *Fl. France* **3**: 348 (1896); Coste, *Fl. France* **1**: 255 cum fig. (1901); Y. Kimura in Nakai & Honda, *Nova fl. jap.* **10**: 21 (1951). Type: Italy, Pedemontana (various localities (TO)).

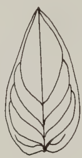
Androsaemum vulgare Gaertner, *De fructibus* **1**: 282, t. 59 f. 2 (1788), nom. illegit. Type as for *H. androsaemum.*

H. floridum Salisb., *Prodr. stirp. hort. Chapel Allerton*: 369 (1796), nom. illegit. Type as for *H. androsaemum.*

H. androsaemum var. *aureum* hort. ex Nicholson, *Handlist trees & shrubs Kew Gardens* **1**: 37 (1894), nomen.

H. bacciforme Bubani, *Fl. pyren.* **3**: 343 (1901), nom. illegit. Type as for *H. androsaemum.*

Icon: Ross-Craig, *Drawings Br. pls* **6**: t. 6 (1952).



Shrub 0·3–0·7 m tall, bushy with numerous stems from branching but not rooting base, with branches erect. *Stems* 2-lined when young, eventually terete; internodes 3–9 mm long, shorter than to exceeding leaves; bark fissured or scaling. *Leaves* sessile, sometimes amplexicaul, without goat-like smell when crushed; lamina (25–)40–120(–150) × 20–80 mm, oblong-ovate or triangular-ovate to broadly ovate, rounded or rarely obtuse, margin plane, base truncate to cordate, paler beneath, not glaucous, papyraceous; venation: 4–5 pairs of ascending main lateral veins, with tertiary reticulum ± prominent on both sides; laminar glands small; intramarginal glands dense. *Inflorescence* 1–11-flowered, from 1–2 nodes with ± condensed internode, corymbose to pseudo-umbellate with branches ± narrowly ascending, without accessory flowers, sometimes with 1–3-flowered branches from node below; pedicels 8–14 mm long; bracts reduced, linear-lanceolate to subulate. *Flowers* 15–25 mm in diam.; buds globose, rounded. *Sepals* 6–12(–15) × 3–7 mm, imbricate, markedly unequal, spreading to deflexed and enlarging after anthesis, deflexed and

persistent in fruit, oblong-ovate to broadly ovate, rounded, 7–9(–11)-veined from base with veins ± densely reticulate; laminar glands punctiform or occasionally striiform; intramarginal glands rather dense. *Petals* golden yellow, not tinged red, incurved, 6–10(–12) × 3–7 mm, equalling or slightly shorter than sepals, obovate, without apiculus. *Stamen fascicles* each with 20–25(–30) stamens, longest 7–11 mm long, *c.* 0·9–1·1 × petals. *Ovary* 4–5 × 3·5–4·5(–5) mm, ellipsoid-subglobose, rounded to truncate; styles 2–2·5 mm long, *c.* 0·5 × ovary, erect, the upper half sharply outcurved; stigmas subcapitate. *'Capsule'* 7–12 × 6–8 mm, broadly cylindric-ovoid or cylindric-ellipsoid to globose, rounded to retuse, thin-walled and fleshy, maturing from reddish to dark reddish-brown or purplish-black, lucent, indehiscent (but sometimes splitting in three if compressed laterally when dry). *Seeds* reddish-brown, *c.* 1 mm long, partially or rarely completely unilaterally winged, without terminal winged appendages. $2n = 40$.

In damp or shaded places, lowland to 1800 m (in Iran).

British Isles (widespread, but absent from NE. [except for naturalised plants], extreme N., Outer Hebrides, and northern islands), Belgium (Ardennes), France (W., also scattered in E. and S. – Oise, Cher, Isère, Aveyron, etc.), Spain (N.), Portugal (N., south to Cintra), Morocco, Algeria, Tunisia, Sicily (W.), Sardinia, Corsica (extinct ?), Italy (NW. south to Toscana, Elba ?, SE. – Ischia, Napoli ?, Basilicata, also elsewhere but possibly naturalised). Yugoslavia (N. – Pula, Croatia, Bosnia, Serbia), Bulgaria (SE.), Turkey (Thrace, Pontus, Amanus), U.S.S.R. (Georgia, Azerbaijan, Daghestan, Turkmenistan), Iran (N. – Azerbaijan, Gilan, Mazanderan, Gorgan). Introduced into Australia, New Zealand (North, South, Stewart, and Campbell Islands), and Chile. Map 32.

GREAT BRITAIN. Somerset: Frome, Orchardleigh, 27.viii.1958, *Wycherley* 267 (BM). Sussex: Hastings, Pett, viii.1914, *Redgrove* s.n. (BM). Norfolk: Happisburg, viii.1928 *Meinertzhagen* s.n. (BM). Hereford: Wye gorge, Dripping Well, 18.vii.1914, *Adamson* s.n. (BM). Caernarvon: Bardsey, vii? 1933, *Butler* s.n. (BM). Westmorland: Grasmere, 22.vii.1939, *Frankland* s.n. (LIV). Dumfries: Brocklehurst, Collin, 5.viii.1952, *Balfour-Browne* 12 (BM). Argyll: Morven, Savory Bay near Lochaline, 13.vii.1966, *Cannon & Kendrick* 221 (BM). Inverness: Isle of Rhum, N. side of Loch Scresort, 5.viii.1959, *Jermy* 338 (BM). W. Ross: near Kyle of Lochalsh, 21.vii.1909, *Marshall* s.n. (BM).

IRELAND. Kerry: Derrynane, Castle Cove, 26.vi.1930, *Foggitt* s.n. (BM). South Tipperary: outside Cappamurra House, 26.vii.1975, *Pankhurst* 192 (BM). Wicklow: Glendalough, 25.viii.1951, *Klingstadt* s.n. (H). Galway: Connemara, near Clifden, Faul, 16.vi.1953, *Whittaker* s.n. (BM). Donegal: Drummonaghan Wood, 26.vii.1886, *Kinahan* s.n. (BM).

BELGIUM. Ardennes (fide van Rompaey & Delvosalle, *Atlas Fl. belge lux.*, ed. 2: carte 417 (1979)).

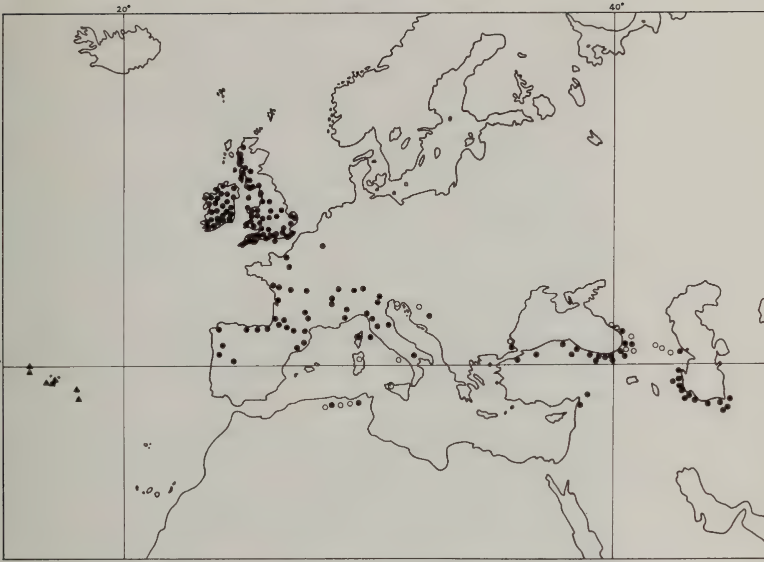
FRANCE. Calvados: Port Usembourg, vii.1868, *Housnot* s.n. (BM). Loire Atlant.: forêt de Gâvre, 18.vi.1878, *Gadeceau* s.n. (BM). Cher: Forét d'Allogny, 7.vii.1851, *Héribaud-Joseph* 817 (BM). Landes: a l'ouest de Bernède, 4 km SSE. de Aire sur l'Adour, 2.vii.1977, *Bamps* 4734 (BM). Pyrenées Atlant.: Cambo, 1880, *Wilmott* s.n. (K); Pyrenées Orient.: Vernet-les-Bains, 22.vii.1926, *Ronniger* s.n. (W). Aveyron: Villefranche, bois de La Baume, vi.1849, *?* (H). Isère: Cult. ex Saint-Savin, près de Bourgoin-Jallieu, bois du Laccas, 250 m, vii–viii.1877, *Barbezat* 163 (H). Alpes Maritimes: Fontan, 18.viii.1886, *Reverchon* 176 (BM).

SPAIN. Cataluña: Gerona, Villa de Arrozos, vi.1932, *Krisogono* 73 (BM). Navarra: Alsasua, 26.vi.1952, *Rovainen* s.n. (H). Vascongadas: Viscaya, Miravalles, 29.vii.1914, *Elias* s.n. (BM). Galicia: La Coruña, near Coruña, viii.1888, *Guendi* s.n. (BM).

PORTUGAL. Minho: Serra do Gerez [Gerêz], 15.vi.1887, *Murray* s.n. (BM). Aveiro: Oliveira d'Azemeis. Coimbra: Coimbra, 1849–50, *Welwitsch* 921 (BM). 15.v.1888, *Murray* s.n. (BM).

ALGERIA. Soummam: Zigalon, near El Kseur, 24.iv.1937, *Alston & Simpson* 37569 (BM).

TUNISIA. Jendouba: Ain-Draham, 1883, *Miss. Bot. Tun. 1883* s.n. (K).



Map 32 Sect. 5. *Androsaemum*: 2. *H. foliosum* ▲, 3. *H. androsaemum* ●, ○ (records).

CORSICA. Haute Corse; Prope Orezza, 1830, *Salis* s.n. (K); Corti to Ajaccio, Vivazione, 500–700 m, 3.vii.1970, *Verdcourt* 4781A (K).

SARDINIA. No detailed record or specimen seen (fide **5**: Pignatti, *Fl. d'Italia* **1**: 345 (1982)).

SICILY. Messina: Mistretta, Boschi di Amidda, vii.1887, *Miojacono*, Pl. Ital. Sel., Cent. IV 370 (BM).

ITALY. Basilicata: Pignola, Acqua fredda, 1200–1450 m, 6.vii.1923, *Gavioli* in *Fiori & Beguinot*, Fl. Ital. Exs., ser. III, 2862 (BM, K). San Marino: Canepa, 26.vi.1912, *Pampanini* s.n. (K). Toscana: Gricigliano presso Firenze, vii.1890, *Martelli* s.n. (H). Liguria: Apuania, Massa Montignosa, 14.vi.1951, *Ranhala* s.n. (H). Piemonte: Valdensa, vi.1852, *Rostan* s.n. (BM). Lombardia: Lago Maggiore, zwischen Stresa und Belgirate, 22.vi.1928, *Ronniger* s.n. (W). Veneto: Verona, Le Ferrazze, 13.vi.1913, *Rigo* s.n. (BM).

SWITZERLAND. Ticino: Brissaga, 1865, *Muret* s.n. (K).

YUGOSLAVIA. Bosnia: Banjaluka, Wald ober dem Tragspitzen, 7.vii.1929, *Ronniger* s.n. (W).

BULGARIA. Strandzha Mts. (fide Jordanov & Kozhukharov in Jordanov, *Fl. Rep. Pop. Bulg.* **4**: 230 (1970)).

TURKEY. Kirklareli: Istranca dağ. between Demirköy and Velikaköy, 24.vi.1960, *Kayacik* 54 (E). Bursa: in Olympo Bythino, *Noë* (K). Bolu: Bolu dağ, 2.vii.1957, *Kuhne* 1065 (E). Kastamonu: Küre to Inebolu, 1000 m, *Czeczott* 567 (E). Sinop: Çangal dağ above Ayancik, 700 m, 26.vii.1962, *Davis* 38162 (E, K). Samsun: Kara dağ, 10 km E. of Samsun, 200 m, 15.vi.1963, *Tobey* 319 (K). Giresun: Tamdere to Yavuzkemal, near Karinca, 1500 m, 13.viii.1952, *Davis* 20761 (BM, E, K). Rize: Pontic Range above Rize, 450 m, 14.v.1960, *Furse & Synge* 147 (K). Gaziantep: Kurd dağ, ix.1891, *Post* (BM).

U.S.S.R. (Transcaucasia). Georgia: Chakvi near Batumi, 30.vii.1979, *Lancaster*

s.n. (BM). Azerbaijan: Baku, Kuba, supra pag. Cziczi inferiore versus, M. Clit dağ, 900 m, 9.vii.1919, *Alexcenko* 1630 (S). Daghestan: Lenkoran, 1878, *Haussknecht* (JE).

IRAN. Azerbaijan: Astara R. gorge, 20 km W. of Astara, 500 m, 21.vii.1964, *Grant* 271 (W). Gilan: Navrud (Asalem) to Herowabad (Khalkhal), 1000–1300 m, 15.iii.1971, *Lamond* 2965 (E). Mazanderan: Elburz Mts, Golban Forest, 1200 m, 31.viii.1967, *Walton* 269 (E). Asterabad: Gorgan, entre Naudeh et Sharud, 1000–2000 m, 11.vi.1956, *Schmid* 6068 (W).

U.S.S.R. Turkmenistan: Turcomania, *Hb. Hooker*. (K).

CULTIVATED. Specimens seen from England, Scotland, France.

NATURALISED. Australia: Tasmania, Port Cygnet, pre-1914, *Kitson* (BM). New Zealand: N. Island, Wellington, Wainui-o-Mata, v.1929, *Meebold* 4622 (M); Stewart Island, near Half Moon Bay, ii.1910, *Chase & Leland* 318 (BM). Chile: Concepcion, San Juan, 1893–6, *Neger* (M); Valdivia, La Union, 10.ii.1964, *Kausel* 4718 (H).

H. androsaemum can be distinguished from both *H. foliosum* and *H.* x *inodorum* (*H. androsaemum* x *hircinum*) by the short styles, the black or dark red-brown baccate fruit, and the petals, which are equal to or shorter than the sepals. The shiny berry is easily detachable from the receptacle and is eaten (and the seeds are dispersed) by birds. If not eaten, after about a month it dries and withers on the plant; but it can be split into three valves by slight pressure, and may do so spontaneously after over-wintering.

The larger-flowered forms of *H. androsaemum* tend to have red-tinged leaves and sepals and larger, cylindric-ovoid fruits that become brownish-red early and ripen to dark reddish-brown; whereas those with smaller flowers tend to have green leaves and sepals and smaller, cylindric-ellipsoid to globose fruits that ripen later to a bright red before becoming shiny black. These forms, however, appear to be linked by a continuous series of intermediates. In addition, a form with yellow-green leaves (var. *aureum* hort.) is sometimes seen in cultivation; and a form with variegated leaves has been found in two gardens in Ireland, having been collected originally at Lisnavagh in Co. Carlow (D. McClintock, pers. comm.; cult. spec. in BM). This form also occurred as a seedling at the Hillier Nursery, Winchester, Hampshire.

The selection of a lectotype of *H. androsaemum* L. is not as simple as it appeared to me to be earlier, when I cited 'Cult. in horto Upsaliensis' in *Fl. Iranica*, Guttiferae: 5 (1968). Linnaeus first cites *Hortus upsaliensis*, in which the phrase-name has been changed from that in *Hort. Cliff.*, 'caule fruticoso ancipiti' having been substituted for the earlier 'foliis ovatis pedunculo longioribus.' He could have observed the ancipitous stems on the Herb. Cliff. specimen also, but no doubt did not happen to have noted this character at the time. Linnaeus also cites Bauhin's *Pinax* and Dodoens' Stirp. Hist. Pempt., finishing with 'Habitat in Angliae, Ilvae sepibus' and the sign for 'tree or shrub'.

The geographical data were derived respectively from Ray and Burser (?); but the first two phrase-names are based on plants seen by Linnaeus himself. No specimen of the plant that he grew in his 'frigidarium' at Uppsala is known to exist (in London, Stockholm, Uppsala, Helsinki, or Moscow); but there is a specimen in Herb. Cliff. (BM). The one is Herb. Linn. (LINN 943.12), of which the provenance is unknown, is not *H. androsaemum* but *H.* x *inodorum* Miller. I therefore select the Herb. Cliff. specimen (p. 380, No. 4), an authentic specimen seen by Linnaeus, as the lectotype of *H. androsaemum*.

3x(61x). **Hypericum** x **inodorum** Miller

Gard. Dict. 8th ed.: no. 6 (1768); N. Robson in *Flora europaea* **2**: 263 (1968), in Green (ed.), *Plants, wild & cult.*: 81 (1973), in *Fl. Gr. Brit. & Ireland* **1**: 000 (1985); [Lancaster], *Hillier's man. trees & shrubs*: 151 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed.: 415 (1973). Type: specimen cultivated in Chelsea Physic Garden, *Miller* (BM!, holotype).

H. elatum Aiton, *Hort. kew* **3**: 104 (1789); Desroux in Lam., *Encycl. méth.* (Bot.) **4**: 156 (1797); A. L. de Jussieu in *Ann. Mus. natn. Hist. nat.* **3**: 162, t. 17 (1804);

Choisy, *Prodr. monogr. fam. Hypéric*: 38 (1821), in DC., *Prodr. syst. nat. regni veg.* **1**: 544 (1824); P. W. Watson, *Dendr. Brit.* **2**: 85 (1825); Syme, *Engl. bot.* 3rd ed.: 265 cum tab. (1865); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed., **21**: 177 (1925) pro parte excl. loc. cit.; Stefanoff in *God. Agr.-les. Fak. Univ. Sofiya* **11**: 144 (1933) pro parte excl. loc. cit.; Turrill in *Curtis's bot. Mag.* **173**: t. 376 (1962) pro parte quoad typum et syn. *H. anglicum, A. pyramidale, A. parviflorum*. Type: cult. Hort. Kew, 1781, *Hb. Goodenough* (K!, holotype).

H. androsaemum sensu Sowerby & Sm., *Eng. bot.*: t. 1225 (1804) et auct.

Androsaemum pyramidale Spach, *Hist. nat. vég.* Phan. **5**: 417 (1836), in *Annls Sci. nat.* (Bot.) II, **5**: 362 (1836); K. Koch, *Hort. dendr.*: 65 (1853); nom. illegit. superfl. Type as for *H. elatum* Aiton.

A. pyramidale forma *grandifolia* Spach, *Hist. nat. vég.* Phan. **5**: 417 (1836). Types: P. W. Watson, *Dendr. brit.* **2**: t. 85 (1825) and Jussieu in *Ann. Mus. natn Hist. nat.* **3**: 162, t. 17 (1804), syntypes.

A. parviflorum Spach in *Annls Sci. nat.* (Bot.) II, **5**: 361 (1836); K. Koch, *Hort. Dendr.*: 65 (1853). Types as for *H. pyramidale* forma *grandifolia* [sic] Spach.

Hypericum anglicum Bertol., *Fl. ital.* **8**: 310 (1853); Babington in *Ann. Mag. nat. Hist.* II, **15**: 92 (1855), in *Trans. bot. Soc. Edinb.* **5**: 42 (1958); Walker-Ârnott in *Ann. Mag. nat. Hist.* III, **6**: 362 (1860). Types: Italy, Venato, R. Brenta at S. Fortunato. *Bertoloni* (BOLO, syntype); woods at Angarano, *Montini* (BOLO, syntype).

H. multiflorum sensu hort. ex Dippel, *Laubholzkunde* **3**: 39 (1893) in synon., non Kunth (1922).

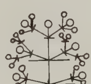
H. x *urberuagae* P. & S. Dupont in *Monde Plantes* **325**: 3 (1958), nom. illegit. altern. Type: Spain, Viscaya, Urberuaga de Ubilla, *P. & S. Dupont* (Herb. Dupont. ?).

Androsaemum x *urberuagae* P. & S. Dupont in *Monde Plantes* **325**: 3 (1858), nom. illegit. altern. Type as for *Hypericum* x *urberuagae*.

Hypericum persistens I. F. Schneider in *Meded. Inst. Vered. Touinbougew., Wageningen* **252**: 22 (1966), in *Dendrofl.* **2**: 22 (1967). Type: cult. in Hort. Wageningen (WAHO).

H. persistens 'Elatum' I. F. Schneider in *Meded. Inst. Vered. Touinbougew., Wageningen* **252**: 22 (1966), in *Dendrofl.* **2**: 22 (1967). Type: as for *H.* x *persistens* I. F. Schneider.

Icon: Syme, *Engl. Bot.* 3rd ed.: t. 265 (1865).



Shrub 0·6–2 m tall, bushy with numerous stems from branching but not rooting base, with branches erect. *Stems* 2-lined when young, eventually terete; internodes 2–8·5 mm long, shorter than to exceeding leaves; bark scaling. *Leaves* sessile to subsessile, sometimes amplexicaul, rarely with goat-like smell when crushed; lamina 35–110 × 20–60 mm, oblong-lanceolate to broadly ovate, subacute to rounded, margin plane, base rounded to cordate, somewhat paler beneath, not glaucous, papyraceous; venation: 4–5 pairs of ascending main lateral veins, with tertiary reticulum ± prominent on both sides; laminar glands small; intramarginal glands dense. *Inflorescence* (1–)3–*c.* 23-flowered, from 1–2 nodes without condensed internode, corymbose to subcorymbose, with branches ± narrowly ascending, without accessory flowers, often with 1–3-flowered branches from node below; pedicels 6–15 mm long; bracts reduced, lanceolate to subulate. Flowers 15–30 mm in diam.; buds globose, rounded. *Sepals* 5–9·5 × 2–5 mm, imbricate, markedly unequal, deflexed and enlarging after anthesis, persistent at least until fruit ripens, oblong or oblong-lanceolate to broadly ovate, subacute to rounded, 5–9-veined from base with veins ± branched and reticulate; laminar glands mostly punctiform; inframarginal glands dense. *Petals* golden yellow, not tinged red, spreading to incurved, 8–15 × 4·5–7 mm, *c.* 1·5–2 × sepals, oblanceolate to narrowly obovate, without or almost without apiculus. *Stamen fascicles* each with 20–30 stamens, longest 10–20 mm long, *c.* 1·2–1·3 × petals. *Ovary* 3·5–6·5 × 2–5 mm, ellipsoid to ovoid-ellipsoid, subacute to subrounded; styles (6–)8–16 mm long, *c.* 1–2·5 × ovary, erect, obtusely divergent in the upper 1/3–1/4; stigmas narrowly capitate. *Capsule* 6–13 × 4–8 mm, ellipsoid or ovoid-ellipsoid to cylindric-ellipsoid, obtuse to rounded, thin-walled and ± fleshy, maturing from cerise or bright red to dark brown, sublucent, sometimes dehiscent at

the apex. *Seeds* reddish-brown, *c.* 1·2–1·5 mm long, partially or rarely completely unilaterally winged, sometimes with terminal winged appendages. 2n = 40.

In damp or shaded places, lowland.

Possibly natural distribution (where areas of parents overlap): SW. France (Pyr. Atl., Landes), NW. Spain (La Coruña, Guipuzcoa ?), Corsica (Bastia), Italy (Liguria). Introduced into and naturalised (or originated de novo) in the British Isles (all countries, mainly S. and W. England and the Channel Islands), France (scattered), Portugal (Porto), Switzerland (Valais), Italy (Veneto), Madeira, New Zealand, Mexico, and Chile.

GREAT BRITAIN. Cornwall: near Menabilly, 1931, *Medlin* s.n. (K). Somerset: Worle, 28.vii.1899, *White* s.n. (BM, K). Surrey: Camberwell, Dulwich Woods, 5.x.1958, *Lousley* s.n. (BM). Essex: Thorpe-le-Soken, vii–viii.1900, *Standen* s.n. (BM, K). Herefordshire: Goodrich, viii.1861, *Watkins* s.n. (BM). Caernarvon: Llanfairfechan, 5.viii.1938, *Last* s.n. (K). Yorkshire: Cayton Bay, near Scarborough, 22.vii.1938, *Evans* s.n. (BM). Cumberland: Sebergham, ix.1886, *Lomax* s.n. (BM). Wigtown: near Portpatrick, *H.B. Balfour* (K). Buteshire: Arran, vii.1840, *Maclagan* s.n. (BM).

IRELAND. Sligo: Lough Gill, 17.viii.1913, *Barton* s.n. (BM). Down: Donard Lodge, ix.1860, *Arnott* s.n. (K).

CHANNEL ISLANDS. Sark: east coast, fl. 19.vii.1953, *Sowerby* 305 (BM).

FRANCE. Maine et Loire: La Baumette, 21.vii.1853, *Genevier* s.n. (BM). Rhône: Arnas, 6.vii.1875, *Gandoger* 808 (BM, JE). Landes: Boucou, près Bayonne, vi.1869, *Bordère* s.n. (K). Pyren. Atlant.: Bayonne, vi.1870, *Bordère* (K).

SPAIN. Galicia: La Coruña, Betanzos, vii.1901, *Peyil* s.n. (BM).

PORTUGAL. Porto: Juxta Oporto, pre-1867, *de Paiva* s.n. (K).

CORSICA. Bastia, 4.vii.1875, *Gandoger* s.n. (FR, JE).

ITALY. Fide Pignatti, *Fl. d'Italia* **1**: 345 (1982).

SWITZERLAND. Valais: Sion, vi.1872, *Wolf* s.n. (K).

MADEIRA. 'Ubique in sepibus et rupestribus', 300–1000 m, vii.–x.1865, *Mandon* 34 (BM, JE, K).

MEXICO. Morelia: Ericón près Morelia, 26.ix.1911, *Arsène* (L).

CHILE. Valdivia: Lake Llanquihue, 1912, *Calvert* s.n. (BM). Chiloe: Concepción, Fundo Piruquina, 28.i.1933, *Belu* s.n. (M).

CULTIVATED. Specimens seen from England, France, Belgium, the Netherlands, Germany, Denmark, Sweden, U.S.A.

H. x *inodorum* appears to have originated spontaneously, both in cultivation (England prior to 1759) and in natural habitats, where the parental species grow together. The hybrids are at least partially fertile (chromosomes of all species in sect. *Androsaemum* so far counted are 2n = 40), and segregation as well as presumed back-crossing has resulted in a range of intermediate forms. The larger-flowered tall forms (*H. elatum*) have *H. hircinum* subsp. *majus* as a parent, whereas in the dwarfer smaller-flowered forms (*H.* x *inodorum* sensu stricto, *H. multiflorum* sensu hort.) the *hircinum* parent is apparently subsp. *cambessedesii* or possibly sometimes subsp. *hircinum*. As there is a continuous range of variation in *H.* x *inodorum* between these extremes, it is not possible to recognise two nothovarieties. On the other hand, segregation and selection have resulted in the establishment of two groups of cultivars (see below, p. 307).

H. x *inodorum* has been the subject of misunderstanding in more than one way:

(i) Aiton (*Hort. Kew.* **3**: 104 (1789)) gave the origin of *H. elatum* as North America, and it was not until the publication of Coulter's account of North American *Hypericum* (in *Bot. Gaz.* **11**: 82 (1886)) that it was firmly recognised as an Old World species.

(ii) Several authors, including Rehder (*Man. Cult. Trees & Shrubs* ed. 2: 641 (1940)), have confused it with *H. grandifolium* and given its natural distribution as the Canary Islands and Madeira, one of the latest being Turrill (*Curtis's bot. Mag.* **173**: t. 376 (1962)). Schneider, who was also misled by Rehder's statement into thinking that *H. elatum* was a Canary Island plant, gave the plant that he knew in

cultivation a new name – *H.* x *persistens* (see synonymy). The label of the plant from Madeira cited above (*Mandon* 34) is almost certainly another result of this confusion; Mandon, having apparently thought that his plant was the same as the one that is widespread on the island (*H. grandifolium*), described it as occurring everywhere: 'ubique'.

Miller chose the epithet *inodorum* to distinguish his species from the well known *H. hircinum*, which always (in the forms then in cultivation) had a goat-like smell. See also Willdenow (1802: 1449). This distinction is usually valid; but, not surprisingly, there are some forms of *H.* x *inodorum* in which the smell characteristic of *hircinum* is quite apparent.

As was mentioned above, two form-groups of *H.* x *inodorum* have been recognised as cultivars.

3xa(61xa). **H.** x **inodorum** 'Elstead'

Hilliers' man. trees & shrubs: 151 (1971); N. Robson in Green (ed.), *Plants, wild & cult.*: 81 (1973). Standard specimen: England, Surrey, Kew, Royal Botanic Gardens, Arboretum, 21.ciii.1960, *Bot. Mag.* II, **173**: t. 376 (K!).

H. elatum 'Elstead Variety' (Ladhams 1933); Chittenden in *J. Roy. Hort. Soc.* **59**: 305, cxxix (1934); Thomas in *Gdnrs' Chron.* **147**: 254 (1960).

H. elatum sensu Turrill in *Curtis's bot. Mag.* **173**: t. 376 (1962) pro parte, quoad tab. et descr. pro parte.

H. persistens 'Elstead' I. F. Schneider in *Meded. Inst. Vered. Touinbougew., Wageningen* **252**: 22 (1966), in *Dendrofl.*, **2**: 22 (1967).

Icon: Turrill in *Curtis's bot. Mag.* **173**: t. 376 (1962).

Flowers 25–30 mm in diam. *Styles c.* 6 mm long, about equalling ovary. *Capsule* 16–17 × 8 mm, becoming bright pinkish-red (not cerise) during maturation.

ENGLAND. Surrey: Kew, Royal Botanic Gardens, 14.viii.1960, *Turrill* (K).

Named cultivars also include 'Summergold' (golden yellow leaves), 'Ysella', 'Goudelsje', 'Hysan' and 'Beatty's Variety'. These all show different forms of variegation and all occasionally appear in catalogues or lists.

4(62). **Hypericum hircinum** L.

Sp. pl.: 784 (1753); Choisy, *Prodr. monogr. fam. Hypéric.*: 39 (1821), in DC., *Prodr. syst. nat. regni veg.* **1**: 544 (1824); Treviranus, *Hyper. gen. sp. animad.*: 7 (1840): R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 177 (1925); Stefanoff in *God. Agr.-les. Fak. Univ. Sofiya* **10**: t. 3 f. 7 (1932), **11**: 143 (1933), **12**: 82 (1934), in *Pflanzenareale* **4**: karte 2a (1933); Sauvage in *Bull. Soc. Sci. nat. phys. Maroc* **38**: 123 (1958); N. Robson in *Fl. europaea* **2**: 263 (1968); Plaisted & Lighty in *Nat. Hort. Mag.* **38**: 130 (1959); Thomas in *Gdnrs' Chron.* **147**: 255 (1960); [Lancaster], *Hilliers' man. trees & shrubs*: 151 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 414 (1973). Types: *Hort. cliff.* 381 [sphalm. 331 in *Sp. pl.*], no. 9; Herb. Linn. 943. 16 (LINN!, lectotype–mihi; BM-Herb. cliff.!, syntype).

Androsaemum hircinum (L.) Spach, *Hist. nat. vég.* Phan. **5**: 419 (1836), in *Ann. Sci. nat.* (Bot.) II **5**: 362 (1836); K. Koch, *Hort. Dendrol.*: 65 (1853); Nyman, *Consp. fl. europ.* **1**: 131 (1878); Rouy & Foucaud, *Fl. France* **3**: 349 (1896); Coste, *Fl. France* **1**: 256 cum fig. (1901).

Icon: Fig. 22.

Shrub (0·2–)0·5–1·8(–3) m tall, bushy with numerous stems from branching but not rooting base, with branches erect to spreading or pendulous. *Stems* 4-lined and ancipitous when young, eventually 2-lined or terete; internodes 2–9 mm long, shorter than to exceeding leaves; bark grey-brown, fissured. *Leaves* sessile to subsessile, sometimes amplexicaul, when crushed usually smelling of goats (caproic acid); lamina 20–65(–75) × (8–)12–27(–35) mm, broadly ovate to triangular-lanceolate, acute to rounded, margin plane or crisped-undulate, base cordate or

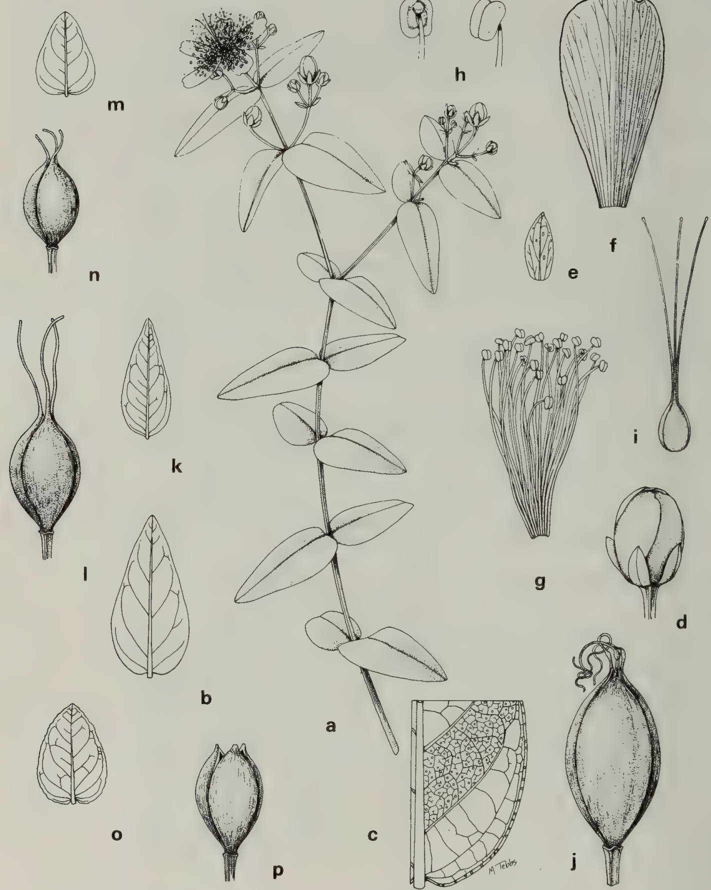
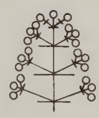


Fig. 22 *H. hircinum*. A. subsp. *majus*: (a) habit; (b) leaf; (c) leaf section; (d) flower bud; (e) sepal; (f) petal; (g) stamen fascicle; (h) anthers; (i) ovary; (j) capsule. B. subsp. *cambessedesii*: (k) leaf; (l) capsule. C. subsp. *hircinum*: (m) leaf; (n) capsule. D. subsp. *albimontanum*: (o) leaf; (p) capsule (a, b, k, m, o × 1; c–g, i, j, l, n × 4; h × 16).

rounded to cuneate or shortly angustate, somewhat paler beneath, very rarely glaucous, chartaceous to papyraceous; venation: 2–4(–5) pairs of ascending main lateral veins, with tertiary reticulum ± prominent on both sides; laminar glands small; intramarginal glands dense. *Inflorescence* (1–)3–*c.*20-flowered, from 1–2 nodes without condensed internode, broadly pyramidal, often with 3-flowered branches from node below and flowering branches from up to 4 nodes below that, the whole then narrowly pyramidal to subcylindric; pedicels 4–10 mm long; bracts rarely foliar, usually reduced, lanceolate to subulate. *Flowers* (20–)25–40 mm in diam.; buds ± globose, rounded. *Sepals* (2–)4–8 × 1–3 mm, imbricate or open, somewhat unequal, decurving and sometimes slightly enlarging after anthesis, deciduous before fruit ripens, lanceolate to narrowly ovate, acute to shortly acuminate, 5–7-veined from base with veins ± branched and reticulate; laminar glands linear to striiform; inframarginal glands ± dense. *Petals* golden yellow, not tinged red, spreading, 11–21 × 4–9 mm, 3–4 × sepals, oblanceolate or oblong-oblanceolate to narrowly obovate, with apiculus subterminal and obsolete or absent. *Stamen fascicles* each with *c.* 20 stamens, longest 12–22 mm long, 1–1·2 × petals. *Ovary* 3–5 × 2–3·5 mm, ellipsoid, acute; styles 10–24 mm, 3–5 × ovary, erect, narrowly divergent in the upper 1/3–1/4; stigmas narrowly capitate. *Capsule* 5–14 × 4–7 mm, ellipsoid or ovoid-ellipsoid to subcylindric, coriaceous, maturing from green to mid-brown, dull, incompletely dehiscent. *Seeds* orange- to reddish-brown, *c.* 1·2–1·5 mm long, completely unilaterally winged, with terminal winged appendages. 2n = 40.



In damp or shaded places, often beside streams, (30–)300–1200 m (to 2100 m in Saudi Arabia).

France (possibly native in SW.; naturalised in W., north to Calvados and Manche, and S.-central), Spain (N. from Cataluña to Santander; naturalised in extreme S. and in Gibraltar), Balearic Islands (Mallorca), Italy (Liguria, Lazio, Campania, Basilicata, Calabria, Elba, Ischia, Lipari Islands), Sicily, Sardinia, Corsica, Morocco, Greece (Peloponnesus), Crete. Andhros, Samos, Rhodes, Turkey (S.), Cyprus, Syria, Lebanon, Israel (N.), Saudi Arabia (Asir). Naturalised also in Portugal, British Isles (all countries), and Yugoslavia (Pula). Map 31.

The natural distribution of *H. hircinum* on the western European mainland is difficult to establish because of the frequency with which it has escaped from cultivation. The map published by Sauvage (1958) includes northern Portugal, the Landes, Pyrenees, and Cataluña, and a continuous strip of land from there down the western side of Italy to Basilicata, but doubtfully excludes Sicily and the extreme south of Calabria. In *Flora Europaea* (Robson, 1968*b*), on the other hand, the regional advisers took the view that the species is not native anywhere in Portugal, Spain, or France, but is so in Sicily. From a study of variation, specimen labels and floras, it would appear that *H. hircinum* grows in natural habitats away from habitation in at least some localities in Spain, France, and Sicily, and that the endemic subspecies of the Balearic Islands (subsp. *cambessedesii*) resembles most closely specimens from Cataluña. It seems likely, therefore, that this species is a native component of the floras of France, Spain, and Sicily. On the Italian mainland, there seems to be a gap in its distribution between (i) Liguria and (ii) Lazio to southern Calabria.

H. hircinum is very variable; but the variation, though clearly geographical, is not sufficiently discontinuous to allow recognition of more than one species. It is possible, however, to distinguish no less than five subspecies (Fig. 8). The most primitive form (of subsp. *majus*), which is the most similar one to *H. grandifolium*, occurs in southern Italy, Sicily, and (rarely) Crete, and rather similar plants are found in Rhodes, S. Turkey, the Levant, and Asir. From the two Mediterranean foci trends may be discerned leading to pendulous branches (Morocco – subsp. *metroi*), to narrower, acute leaves and smaller parts (Liguria, Pyrenees etc., ending in the Balearic Is. – subsp. *cambessedesii*), to smaller, broader, rounded leaves with plane margin and smaller fruits (Sardinia, Corsica – subsp. *hircinum*), and to smaller, broader, apiculate to rounded leaves with crisped-undulate margin and smaller fruits (Cyprus, Samos, Andros, Greece, Crete – subsp. *albimontanum*).

The description of *H. hircinum* L. in *Species plantarum* is clearly based primarily

on that in *Hortus Cliffortianus*, the phrase name being taken directly from this work. It does not indicate any particular subspecies. There is one specimen of *H. hircinum* in Herb. Cliff. (BM) and a duplicate of it in the Linnaean Herbarium (LINN). One of these is clearly the indicated lectotype, and I have selected the one in Herb. Linn. (943.16). Both these specimens, however, are clearly of the subspecies from Corsica and Sardinia (subsp. *obtusifolium* (Choisy) Sauvage), which must therefore become subsp. *hircinum*. Linnaeus appears to have based his concept in 1753 of *H. hircinum* largely on this subspecies; whereas his *Hort. Cliff.* synonymy (1738) included 'Hypericum frutescens maj. & minus. *Dill. elth.* 182. t. 151, f. 181, 182', in *Species plantarum* he omitted 'majus' and 'f. 181'. The other citations in *Species plantarum* (to 'Bauh. pin.' and 'Clus. hist.'), as well as the distribution (*Habitat in* Sicilia, Calabria, Creta'), refer in part to other subspecies; but this fact cannot be taken as an indication that another element should be chosen as lectotype. The subspecies called subsp. *hircinum* by Sauvage therefore requires another name, and it is appropriate to use the Dillenian epithet *majus* from *Hortus elthamensis*.

4a(62a). **H. hircinum** subsp. **majus** (Aiton) N. Robson, **stat. nov.**

H. hircinum [var.] α *majus* Aiton, *Hort. kew.* **3**: 105 (1789). Type: Dillenius, *Hort. elthamensis*: t. 151, f. 182 (1732).

H. hircinum sensu Choisy in DC., *Prodr. syst. nat. veg.* **1**: 544 (1824) pro parte, excl. β *obtusifolium*; P. W. Watson, *Dendrol. brit.* **2**: t. 86 (1825); Syme, *Eng. bot.* 3rd ed.: t. 266 (1865); Boissier, *Fl. orient.* **1**: 788 (1867) pro parte, excl. spec. graec. et cret.; Willk. & Lange, *Prodr. fl. hisp.* **3**: 589 (1878); Fiori & Paoletti, *Nuovo fl. analit. Italia* **1**: 520 (1924); Post, *Fl. Syria, Pal. & Sinai* 2nd ed. **1**: 228 (1932); H. Lindberg in *Acta Soc. sci. fenn.* II B, **2** (7): 23 (1946); Gismondi, *Prosp. fl. ligust.* 336 (1950); K. H. Rechinger in *Arkiv. för Bot.* II, **5**: 291 (1960); Zohary, *Fl. Palaest.* **1**: 221, t. 324 (1966); N. Robson in Davis, *Fl. Turkey* **2**: 366, f. 13(4), map 20 (1967); Mouterde, *Nouvelle Fl. Lib. Syrie* **2**: 520, t. 225 f. 1 (1970); Zangheri, *Fl. Italica* **1**: 394 (1976); Fournier, *Quatre Flores de France* 2nd ed.: 456 (1977).

H. hircinum subsp. *hircinum* sensu Sauvage in *Bull. Soc. Sci. nat. phys. Maroc* **38**: 127 (1958).

Icones: Zohary, *Fl. Palaest.* **1**: t. 324 (1966); Fig. 22A.

Plant (0·5–)1–1·5 m tall, with stems erect or ascending. *Leaves* 30–75 × (10–) 14–32 mm, narrowly ovate to lanceolate or triangular-lanceolate, acute to obtuse or more rarely rounded, margin plane, base subcordate to rounded, goat-scented. *Flowers* 25–40 mm in diam. *Petals* (13)15–21 mm long. *Styles* (13)15–24 mm long. *Capsule* 8–14 × 5–7 mm.

N. and S. Spain, SW. France, NW. and SW. Italy and adjacent islands, N. Sicily, Crete, Rhodes, S. Turkey, Syria, Lebanon, N. Israel, Saudi Arabia (Asir). Naturalised elsewhere (see p. 309). Map 31.

GREAT BRITAIN (naturalised). Cornwall: near Par Harbour, 15.ix.1948, *Alston* s.n. (BM). Somerset: Clevedon, Court Hill, 16.vii.1884, *White* s.n. (BM). Sussex: Surrey Hatch, Fernhurst, 22.viii.1918, *Barton* s.n. (BM). Middlesex: London, Westminster, wall of The Mall by Marlborough House, x.1968, *McClintock* s.n. (BM). Norfolk: Holkham, 18.viii.1882, *Linton* s.n. (BM). Pembroke: Hundleton, near Pembroke, vii.1916, *Wallis* s.n. (BM). Caernarvon: Llanfairfechan, 26.ix.1884, *Bailey* s.n. (BM). Anglesey: Garth Ferry, 8.viii.1936, *Redgrove* s.n. (BM). Lancashire: Southport, Crossens, 13.viii.1949, *Holder* 4944 (LIV). Yorkshire: Settle, 19.ix.1868, *Joad* s.n. (K). Wigtownshire: Sorbie, 1897, *McAndrew* s.n. (BM). Inverness: North Ballahulish, 11.viii.1939, *Wilmott* s.n. (BM).

IRELAND (naturalised). Cork: near Cork, Glanmire, by T11, 2.viii.1975, *Pankhurst* 273 (BM). Mayo: Bongor Erris, viii.1957, *McClintock* s.n. (BM).

FRANCE (naturalised and ? native). Calvados: Vierville, vii.1925, *Bédel* 401 (BM). Indre-et-Loire: Locher, 29.vii.1857, *Genevier* s.n. (BM). Loire Atl.: vis à vis le Bois Cillac, viii.1891, *Le Pellerin* s.n. (BM). Char. Mar.: Dompierre, viii.1887, *Teneron* s.n. (BM). Vendée: Noirmoutier, vii.1869, *Viaud-Graud-Marais & Gobert*

s.n. (BM). Landes: Castillon-sur-Tarnas, 27.vi.1881, *Blanchet* s.n. (BM, E). Pyr. Atl.: St. Esprit près Bayonne, 19.vii.1880, *Bonnet* s.n. (K). Rhône: Denivé, 7.vii.1875, *Gandoger* s.n. (FR). Côte d'Or: Pouillenay, 2.x.1929, *Desplantes* in *Duffour* 5856 (BM).

SPAIN (native ?). Cataluña: Figueras, fossé en face de Molí de la Torre, 11.vii.1912, *Joseph* in *Sennen* 1378 (BM, E, JE). Asturias: Santander, 10.x.1851, *Lange* (K).

GIBRALTAR (naturalised). Gibraltar, 23.xii.1840, *Lemann* (K).

PORTUGAL (naturalised). (Fide Franco, *Nova Fl. Port.* **1**: 448 (1971).)

ITALY. Liguria: near Genoa (fide Parlatore, *Fl. Ital.* **5**: 507 (1872)). Toscana: Elba, 18.vii.1837, *Marciana* (E). Lazio (fide Pignatti, *Fl. d'Italie* **1**: 345 (1982)). Campania: Positano (near Amalfi), 13.vii.1953, *Davis* 17431A (E); Isola d'Ischia, 18.viii.1891, *Martelli* (E). Puglia, Basilicata (fide Pignatti, *loc. cit.*). Calabria: 4 km north of Sinopoli, 510 m, 30.viii.1966, *Lambert* 351 (BM). Lipari Is. (fide Parlatore *tom. cit.*: 508).

SICILY. Palermo: Palermo, vi.1902, *Ross* 319 (BM, E, JE). Messina: *c.* 12 km NW. of Floresta towards Tortorici, *c.* 1300 m, 2.vi.1979, *Davis & Sutton* 64337 (BM). Catania: *c.* 8 km W. of Zafferana Etnea, slopes of Etna, *c.* 1000 m, 5.vi.1979, *Davis & Sutton* 64520 (BM).

YUGOSLAVIA (naturalised). Pula: Molara fra Barana e Campagnano, 22.vi.1859, *Haeckel* s.n. (JE).

GREECE. Dhodhekanisos: Rodhos, Monte Profeta prope Salakos, *c.* 300 m, 2.vii.1935, *K. H. Rechinger* 8497 (BM, K).

CRETE. Lasithi: Mt. Aphendhi Kavutsi, 23.vi.1937, *Lempberg* 548 (K).

TURKEY. Antalya: Gebiz (Pisidia). Bozburum dağ at Penargozu yayla, 600 m, 23.vii.1949, *Davis* 15394 (E, K). Konya: Near Ermanek, 1872, *Péronin* 153 (K, S). Içel: Silifke to Anamur, 50 m, 9.Ix.1962, *Kayacik* 2927 (E). Seyhan: Amanus Gebirge zwischen Osmaniye und Harpuz, *c.* 900 m, 13.vii.1978, *Ehrendorfer, Sorger et al.* 787-35-6 (WU). Antakya: Iskenderun, between Soğukaluk and Karliktefe, 18.vii.1971, *G. & E. Sezik* 165 (BM).

SYRIA. Halep: Kurd Dagh, ix.1891, *Post* s.n. (K). Latakia: Monts Nusairy [Jebel el Ansariye], Ain-Halakim, 750–900 m, vi.1910, *Haradjian* 3474 (K). Damascus: NW. of Damascus, W. of Souk Wadi Barada, Jabal Hafiel, 21.vi.1963, *Barkoudah* 652 (E).

LEBANON. Becharre, 18.viii.1945, *Davis* 10088 (E); ad Brummana, 700–800 m, 7.vii.1897, *Bornmüller* 237 (E, JE, K); Antilebanon, Jdeide village, 750 m, 31.vii.1945, *Harding, Hardy & Whitehorn* (BM).

ISRAEL. Dan: Reserve near source of the Jordan. 18.iii.1967, *Hepper* (K).

SAUDI ARABIA. Asir: Bani Shahr, 2250 m, 8.vi.1946, *Thesiger* s.n. (BM); Taif-Abha road, 12 km S. of An Numas, Taunoumah, 1800 m, 15.iv.1979, *Collenette* 1396 (K).

CULTIVATED. Specimens seen from England, Germany, and U.S.A.

4b(62b). **H. hircinum** subsp. **cambessedesii** (Nyman) Sauvage

in *Bull. Soc. Sci. nat. phys. Maroc* **38**: 127 (1958). Type: (as for *H. canariense* sensu Cambessèdes) Majorca, 'In insulae Majoris torrente dicto Malluch prope Lluch', 1824, *Cambessèdes* (K!, holotype).

H. hircinum [var.] β *minus* Aiton, *Hort. kew.* **3**: 105 (1789) pro parte, quoad specim. 'Kew 1777' (BM): Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 414 (1973).

H. canariense sensu Cambessèdes, *Enum. pl. ins. Balear.*: 54 (1827).

Androsaemum cambessedesii Nyman, *Consp. fl. europ.*: 131 (1878). Type as for *H. canariense* sensu Cambessèdes (1827).

Hypericum cambessedesii (Nyman) Cosson ex Marès & Vigin., *Cat. rais. pl. Baléar.*: 330, t. 3 (1880); Knoche, *Fl. Balear.* **2**: 183 cum carta (1922); Stefanoff in *God. Agr.-les. Fak. Univ. Sofiya* **10**: tt. 2. f. 6, 3 f. 8 (1932), ibid. **11**: 143 (1933), **12**: 82 (1934), in *Pflanzenareale* **4**: karte 2a (1933).

H. minus sensu hort. ex Nicholson, *Handlist trees & shrubs Kew Gardens*: 39 (1894), in synon.

H. hircinum var. *cambessedesii* (Nyman) Ramos in *Trab. Dep. Botánica Ciudad Univ., Madrid* **12**: 49 (1983).

Icones: Marès & Vigin, *Cat. rais. Pl. Balear.*: t. 3 (1880); Fig. 22b.

Plant 0·2–1 m tall, with stems erect. *Leaves* 22–48 × 7–20 mm, lanceolate to triangular-lanceolate, subacute to obtuse, margin plane, base rounded to cuneate, goat-scented. *Flowers* 20–30 mm in diam. *Petals* 10–15 mm long. *Styles* 10–13 mm long. *Capsule* 8–14 × 5–7 mm.

Balearic Islands (Mallorca). Map 31.

BALEARIC ISLANDS. Mallorca: In montibus l. Prats de Massonelles, pr. Lluc, 1000 m, 27.vi.1935, *Gros* in Fl. Iber. Sel., Cent. II, 147 (BM, JE, K); *c.* 1·5 km inland from mouth of Torrente de Pareis towards monastery of Lluch, *c.* 60 m, 13.ii.1971, *L. F. & I. K. Ferguson* 2945 (BM).

CULTIVATED. Specimens seen from England (from earlier than 1777).

Although the epithet *minus* was originally applied by Dillenius to the taxon that has to be known as subsp. *hircinum* (i.e. subsp. *obtusifolium* (Choisy) Sauvage), Aiton's confusion of this with subsp. *cambessedesii* has resulted in the latter's currently being called 'var. *minus*' in horticultural circles. The confusion between this subspecies and *H. canariense*, which was originated by earlier authors than Cambessèdes (1827)*, has persisted down to the present day, so that *H. cambessedesii* has been recorded in error for Macaronesia by several authors.

Subsp. *cambessedesii* is very similar to the form of subsp. *majus* in Cataluña, differing essentially from it only in size of parts.

4c(62c). **H. hircinum** subsp. **metroi** (Maire & Sauvage) Sauvage

in *Bull. Soc. Sci. nat. phys. Maroc* **38**: 127 (1958). Type: Morocco, Mont Tazzeka, vers 1200 m, *Métro & Sauvage* s.n. (MPU, holotype).

H. metroi Maire & Sauvage in *Bull. Soc. Hist. nat. Afr. Nord* **31**: 13 (1940); Sauvage in *Trav. Inst. sci. cherif.* (Bot.) **8**: 67–72, f. 3 (1956). Type as above.

Icon: Sauvage in *Trav. Inst. sci. cherif.* (Bot.) **8**: 69, f. 3 (1956).

Plant 1–3 m tall, with stems spreading to pendent. *Leaves c.* 50–70 × 16 mm, narrowly ovate or lanceolate to triangular-lanceolate, subacute to obtuse, margin plane, base rounded, not goat-scented. *Flowers* 30–40 mm in diam. *Petals* 16–20 mm long. *Styles* 12–17 mm long. *Capsule* 10–12 × 7 mm.

Morocco (Moyen Atlas – massif du Tazzeka). Map 31.

MOROCCO. Moyen Atlas: Taza distr., Oued Rmila, 1000 m, 15.xi.1970, *Søndergaard* s.n. (E).

Subsp. *metroi* is very similar to the large-flowered form of subsp. *majus* from southern Italy, differing essentially from it only in habit and in the absence of scent.

4d(62d). **H. hircinum** subsp. **hircinum**

H. hircinum [var.] β *minus* Aiton, *Hort. kew.* **3**: 105 (1789) pro parte, quoad syn. Dillen.

H. hircinum [var.] β *obtusifolium* Choisy in DC., *Prodr. syst. nat. veg.* **1**: 544 (1824). Type: Corsica, 'In petrosis humidis montium Corsicorum, 1821,' *Salzmann* (G – DC!, holotype).

H. hircinum var. *pumilum* P. W. Watson, *Dendrol. brit.* **2**: t. 87 (1825). Type: England (cultivated), London 'Mr Knight's, King's Road, Chelsea, 13.ix.1821'. No specimen traced.

H. hircinum sensu Moris, *Fl. Sardoa* **1**: 316 (1837); Briquet, *Prodr. fl. Corse* **2** (2): 143 (1936) et auct. cors. et sard.

* Two Miller specimens at BM, one in the general collection and the other in Herb. Sloane t. 288 f. 74 (both of which are *H. hircinum* subsp. *cambessedesii*), have 'Hypericum frutescens canariense multiflorum. Hort. Amstel. 2. 135' on their label, although this phrase name refers to *H. canariense* L.

H. hircinum subsp. *obtusifolium* (Choisy) Sauvage in *Bull. Soc. Sci. nat. phys. Maroc* **38**: 127 (1958).

Icones: P. W. Watson, *Dendrol. brit.* **2**: t. 87 (1825); Fig. 22C.

Plant c. 1 m tall, with stems erect. *Leaves* 25–45 × 12–27 mm, ± broadly ovate, obtuse to rounded, margin plane, base truncate to rounded, rarely goat-scented. *Flowers* 25–40 mm in diam. *Petals* 15–18 mm long. *Styles* 14–20 mm long. *Capsule* (6–)8–9 × 4–6 mm.

Sardinia, Corsica. Map 31.

SARDINIA. Gallara: secundum Rio Mannu (Rio di Liscia), loco dicto il Vignale prope Luogosanto, 150 m, vii.1905, *Vaccari* in Fiori & Béguinot, Fl. Ital. Exsicc., ser. II, 816 (BM, E, K); Arrondissment de Tempio, Monte Limbardo, 14.vii.1882, *Reverchon* 261 (E, JE, K).

CORSICA. Bastia, 27.v.1900, *Kugler* s.n. (JE); Evisa, 840 m, 3.viii.1932, *Aellen* 30 (K); Bastélica, 5.vi.1878, *Reverchon* 5 (E, Fr, K); Montagne de Cagna, Ansteig zum Monaco-Pass, nahe von Gianuccio, 550 m, 19.vii.1973, *Bocquet* 15507 (BM).

CULTIVATED. Specimens seen from England (1974) and Holland (Herb. cliff).

H. hircinum subsp. *hircinum* was obviously well known to 18th century botanists and gardeners, but it seems to be due merely to chance that Linnaeus was more familiar with it than with the more widespread subsp. *majus*. Although it is quite distinct from subsp. *majus* in Corsica, the differences in Sardinia are not always so clear.

In gardens, P. W. Watson's var. *pumilum* (which is clearly subsp. *hircinum* from his illustration) has been confused with var. *minus* Aiton (= subsp. *cambessedesii*) because Aiton's variety (q.v.) includes elements of both subspecies. The epithet *minus*, however, originated with Dillenius, *Hort. Elthamensis*: t. 151 f. 182 (1732); and his illustration is clearly of subsp. *hircinum*.

4e(62e). **H. hircinum** subsp. **albimontanum** (Greuter) N. Robson, **stat. nov.**

H. hircinum L., *Sp. pl.*: 784 (1753) pro parte, quoad loc. Creta cit.

H. hircinum sensu Sibth. & Sm., *Fl. Graeca* **8**: 53, t. 773 (1833); Hayek, *Prodr. fl. pen. Balc.* **1** (4): 531 (1925); K. H. Rechinger, *Fl. Aegaea*: 262 (1943) pro parte, excl. pl. Rhodenses; N. Robson in Meikle, *Fl. Cyprus* **1**: 294 (1977); et auct. Graec.

H. hircinum var. *albimontanum* Greuter, *Prem. coll. OPTIMA, Crete 1975, guide excurs.*: 25 (1977). Type: Crete, Ep. Sfakia, b.Aj. Rumeli, 100 m, 10.vii.1961, *Greuter* 3837 (Herb. Greuter., holotype; G, W, Z, isotypes).

Icones: Sibth. & Sm., *Fl. graeca* 8: t. 773 (1833); Fig. 22D.

Plant c. 0·5–1 m tall, with stems erect. *Leaves* 30–45 × 12–35 mm, broadly ovate to ovate-lanceolate, apiculate or obtuse to rounded, margin plane or usually ± markedly crisped-undulate, base cordate to cuneate or shortly angustate, goat-scented. *Flowers* 28–40 mm in diam. *Petals* 18–20 × 10 mm. *Styles* 14–21 mm long. *Capsule* 5–8 × 5–6 mm.

Greece (Peloponnisos: Mt. Malevo), Crete, Kikladhes (Andhros), Dhodhekanisos (Samos), Cyprus. Map 31.

GREECE. Peloponnisos: M. Malevo Laconiae prope Platanos, 1050 m, 4–16.vii.1856, *Orphanides* 820 (E, JE).

CRETE. Kissamos: Helos (Enneachoria), 400 m, vi.1932, *Atchley* 1371 (K). Selinos: in umbrosis vallis pluvii Pelekanotikos prope Vutas, *c.* 300 m, 2.vi.1942, *K. H. Rechinger f.* 13553 (Herb. Huber-Morath). Khania: Ardiini, vii.1943, *K. H. Rechinger f.* 15070 (BM); Perivoglia, 1820, *Sieber* s.n. (E, FR, G-DC, H, JE, K). Sphakia: Levka Ori, inter Samaria et casam pastoralem Potamos, *c.* 900 m, 15.vi.1942, *K. H. Rechinger f.* 13808 (BM, K). Rethymno: Bene, 31.v.1915, *Gandoger* 12460 (K). Lassithi: Kera below Lassithi-Plain, 800 m, 12.viii.1971, *Jermy & Brownsey* 9031 (BM). Hierapetra: Mt. Aphendhi Kavutsi, 23.vi.1937, *Lempberg* 548 (K).

KIKLADHES. Andhros: prope Palaeochori, vi.1930, *Guiol* s.n. (BM).

DHODHEKANISOS. Samos: Infra pagum Nenedes, *c.* 100 m, 6.iv.1934, *K. H. Rechinger f.* 3783 (BM, K).

CYPRUS. Lapithos, 240 m, 6.v.1955, *Merton* 2235 (K).

CULTIVATED. Living plants seen in England 1981–1983.

The relatively broad leaves with crisped-undulate margin of typical *H. hircinum* subsp. *albimontanum* appear quite distinct from those of subsp. *majus*. There are specimens, however (e.g. *Reverchon* 7.vii.1883, from Malaxa, Crete), in which these characters are less pronounced; and true subsp. *majus* occurs in eastern Crete and in Rhodes.

Sect. 6. **INODORA** Stef.

in *God. Agr. -les. Fak. Univ. Sofiya* **11**: 147 (1933) ('*Inodorum*').

Shrub up to 1·5 m tall, deciduous, glabrous, without dark glands; branching lateral. *Stems* 4-lined, ± compressed when young, becoming 2-lined. *Leaves* opposite, decussate, shortly petiolate, free, deciduous at basal articulation; lamina entire, with venation pinnate, closed, the tertiary, densely reticulate; laminar glands punctiform, pale; marginal gland dots pale; ventral glands absent. *Inflorescence* 1–*c.* 30-flowered, branching dichasial/monochasial from 1–3 nodes, sometimes with subsidiary branches; bracts and bracteoles foliar or reduced, sometimes sepalline. *Flowers* stellate, homostylous. *Sepals* 5, free, persistent, with margin entire or glandular: veins (3)5–7, reticulately branched; laminar glands linear to punctiform, pale; marginal glands absent or sessile to shortly stipitate, yellowish. *Petals* 5, persistent, without apiculus, margin glandular; laminar glands numerous, pale, linear. *Stamen fascicles* 5, free, persistent, each with *c.* 10 stamens; filaments united very shortly; anthers yellow, gland amber; pollen type III. Ovary with 3–4 loosely axile placentae, ∞-ovulate; styles 3–4, free; stigma small. *Capsule* 3–4-valved, subcoriaceous, longitudinally vittate. *Seeds* cylindric, not carinate or winged, without winglike apical expansion; testa linear-reticulate.

Basic chromosome number (x): 10; ploidy 4.

Habitat: forest and shaded places, 0–670 m.

Distribution: Turkey, U.S.S.R. (Georgia).

1 species.

1(63). **Hypericum xylosteifolium** (Spach) N. Robson

in *Notes Roy. bot. Gard. Edinb.* **27**: 185 (1967), in Davis, *Fl. Turkey* **2**: 366, f. 11, map 20 (1967); [Lancaster], *Hilliers' man. trees & shrubs*: 152 (1971); Bean, *Trees & shrubs hardy in Br. Isles* 8th ed. **2**: 423 (1973). Type: Turkey, 'Hypericum cappadocicum frutescens, foetido simile sed inodorum', *Tournefort* [*Cor. Inst. Rei Herb.*: 18 (1703)] (P, holotype; BM!).

H. inodorum Willd., *Sp. pl.* **3**: 1449 (1802); Choisy, *Prodr. monogr. fam. Hypéric.*: 39 (1821), in DC., *Prodr. syst. nat. veg.* **1**: 544 (1824); Boissier, *Fl. orient.* **1**: 789 (1867); Dippel, *Handb. Laubholzk.* **3**: 41, f. 24 (1893); Lipsky, *Fl. Kavk.*: 258 (1899); Woronow in Kusn., N. Busch & Fomin, *Fl. Cauc. Crit.* **3** (9): 12 (1906); R. Keller in Engler & Prantl, *Nat. Pflanzenfam.* 2nd ed. **21**: 177 (1925); Stefanoff in *God. Agr.-les. Fak. Univ. Sofiya* **10**: tt. 2 f. 10, 3f. **11** (1932), ibid. **11**: 148 (1933), ibid. **12**: 82 (1934), in *Pflanzenareale* **4**: Karte 2b (1933); Gorshkova in Shishkin & Bobrov, *Fl. U.R.S.S.* **15**: 217, t. 9 f. 3 (1949); Plaisted & Lighty in *Nat. Hort. Mag.* **38**: 130 (1959); Kem.-Nat. in *Fl. Gruzii* **6**: 217 (1960); Grossheim, *Fl. Kavk.*, ed. 2, **6**: 168, karte 182 (1962). Type: Turkey, 'Hypericum cappadocicum frutescens, foetido simile sed inodorum', *Gundelsheimer* (B-WILLD, holotype).

Androsaemum xylosteifolium Spach, *Hist. nat. vég.* Phan. **5**: 420 (1836); Jaub. & Spach, *Ill. pl. orient.* **1**: 74, t. 38 (1842).

Hypericum ramosissimum Ledeb., *Fl. ross.* **1**: 449 (1842). Type: U.S.S.R., Georgia, 'Guriel in depressis', *Nordmann* 396 (H!, lectotype–mihi).

H. ramosissimum [var.] α *subuniflorum* Ledeb., loc. cit. (1842). Type: U.S.S.R.,

Georgia, 'In umbrosis sylvis per Imereti, Mingreli et Guriel frequens', vi.1830, *Nordmann* (H!, holotype).

H. ramosissimum [var.] β *intermedium* Ledeb., loc. cit. (1842). Type: U.S.S.R., Georgia, Imeretia, *Nordmann* 131 (H!, holotype).

H. ramosissimum [var.] γ *multiflorum* Ledeb., loc. cit. (1842). Type: U.S.S.R., Georgia, 'Guriel in depressis', *Nordmann* 396 (H!, holotype).

H. rariflorum Steven ex Rupr., *Fl. Cauc.*: 298 (1869), in synon.

H. inodorum var. *subuniflorum* (Ledeb.) R. Keller ex Somm. & Lev. in *Acta Horti Petrop.* **16**: 93 (1900).

H. inodorum var. *intermedium* (Ledeb.) R. Keller ex Somm. & Lev., loc. cit. (1900).

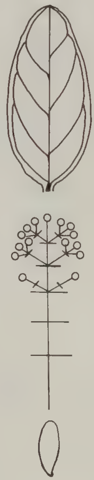
H. inodorum var. *multiflorum* (Ledeb.) R. Keller ex Somm. & Lev., loc. cit. (1900).

H. inodorum var. *sommieri* R. Keller ex Somm. & Lev., loc. cit. (1900). Type: U.S.S.R., Georgia, Namachvani, 23.vii.1890, *Sommier & Levier* s.n. (FI, holotype).

H. inodorum var. *glandulosum* Stef. in *Kew Bull.* **1931**: 29 (1931). Type: U.S.S.R., Georgia (?), 'Armenia', *Szovitz* s.n. (K!, lectotype–mihi; BM!, UPS!); U.S.S.R., Georgia, 'Caucasus', 1838, *Ledebour* s.n. (K!, syntype).

H. inodorum var. *integrisepalum* Stef., loc. cit. (1931). Type: Turkey, Rize, 'Falaises entre Rhizé et Mapavré (Lazistan)', *Balansa* 1377 (K!, holotype; BM!, G!, JE!).

Icones: Jaub. & Spach, *Ill. pl. orient.* **1**: t. 38 (1842); Fig. 23.



Shrub up to 1·5 m tall, deciduous, with branches erect to spreading. *Stems* green to pinkish, 4-lined and ancipitous when young, soon 2-lined, eventually terete; internodes 10–40 mm long, shorter than leaves; bark fissuring. *Leaves* petiolate, with petiole 4–10 mm long; lamina (15–)20–73 × 8–26 mm, oblong or elliptic to lanceolate or oblong-ovate, rounded or truncate to apiculate or obtuse, margin plane, base rounded to broadly cuneate, paler beneath, not glaucous, chartaceous; venation: (3)4–6 pairs of ascending main lateral veins, not always distinct from the midrib branches, with tertiary reticulation dense, conspicuous; laminar glands small; intramarginal glands dense. *Inflorescence* 1–7(–*c.* 25)-flowered, terminal, broadly pyramidal to subcorymbiform, from 1–2(3) nodes, sometimes with 1–2 pairs of subsidiary branches; pedicels 4–7(–10) mm long; bracts foliar or reduced or linear, and then sometimes with sessile yellowish marginal glands, deciduous. *Flowers* 15–30 mm in diam., stellate; buds ellipsoid, rounded. *Sepals* 4·5–12 × 1·3–2·5 mm, open (not imbricate), subequal to unequal, very narrowly oblong or narrowly elliptic to oblanceolate-spathulate, acute, margin entire or with sessile to shortly stipitate yellowish flat-topped glands; (3)5–7-veined reticulately branched, midrib distinct; laminar glands linear to punctiform. *Petals* golden yellow, not tinged red, spreading, 8–15 × 1·5–4·5 mm, *c.* 1·3–2 × sepals, narrowly oblanceolate to narrowly obovate, without apiculus, margin with spaced sessile dark red glands. *Stamen fascicles* each with 10–11 stamens, longest (8–)12–15 mm long, about equalling petals; anthers pale orange. *Ovary* 2·5–3·5 × 2–3 mm, ovoid-conic to subglobose; styles 7–9 mm long, 2·5–3 × ovary, free, erect to suberect, narrowly divergent in upper 1/3. *Capsule* 5–7 × 5–7 mm, subglobose to globose. *Seeds* pale brown, *c.* 0·7 mm long, cylindric, not carinate, shallowly linear-foveolate. 2n = 40.

Deciduous forest, shady banks and cliffs, 0–670 m.

Turkey (Giresun, Trabzon, Rize, Çoruh), U.S.S.R. (Georgia). Map 33.

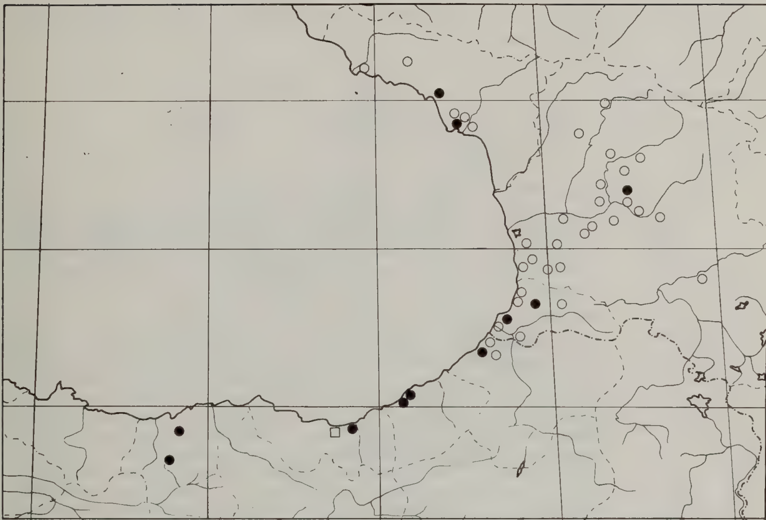
TURKEY. Giresun: 25 km S. of Giresun, 500 m, 7.vii.1969, *Sorger* 69-23-28 (BM, Hb. Sorger). Trabzon: Of district, Sürmene to Of, coast, 11.vii.1958, *Huber-Morath* 14973 (Hb. Hub.-Mor.). Rize, 100 m, 30.vi.1931, *Görz* 683 (BM). Çoruh: Hopa, near sea level, 22.vi.1957, *Davis* 29871 (BM, E, K).

GEORGIA. Adzharia: Chakvi near Batumi, 30.vii.1979, *Lancaster* s.n. (BM). Imeretia: In sylva Sagori prope Kutais, vi.1931, *Woronow* IX 432 (K). Abkhasia: Sukhumi, 20 m, 11.vi.1959, *Davis* 33655 (E, K).

ENGLAND (naturalised). North Yorkshire: Ripon, near Monkton Moor, 1979, *Houseman* s.n. (BM). Lancashire: Silverdale, Elmslack Well, Eaves Wood, viii.1978, *Jepson* s.n. (BM).

CULTIVATED. Specimens seen from England, Scotland, and Sweden.

Fig. 23 *H. xylosteifolium*: (a) habit; (b) leaf section; (c) flower bud (sepals entire); (d) flower bud (sepal margin glandular); (e) sepal; (f) petal; (g) stamen fascicle; (h) anthers; (i) ovary; (j) capsule (a × 1; b × 4; c, d, j × 6; e–g, i × 10; h × 40). (a, b, d–i) *Görz* 690: (c) *Davis & Hedge* D. 29871; (j) *Lancaster* s.n.



Map 33 Sect. 6. *Inodora*: 1. *H. xylosteifolium* ●, ○ (Fl. Kavkasa, ed. 2: additional records); Sect. 3. *Ascyreia*: 14. *H. calycinum* □ (part; see also Map 13).

H. xylosteifolium has the appearance of a small-flowered *H. monogynum*, but taller and with persistent petals and stamens and fewer, free styles. It forms small thickets with spreading leafy branches and relatively inconspicuous flowers. There is some evidence to suggest that it flowers more freely in the (wetter) west of Britain than in the (drier) east.

None of the described varieties of *H. xylosteifolium* appear to be distinct. Those of Ledebour merely reflect variation in luxuriance of growth. On the other hand, the forms with (respectively) larger entire sepals (and bracts) and smaller gland-fringed ones represent the extremes of a west–east cline. All the Georgian plants that I have seen have gland-fringed sepals and bracts, whereas in most of the Turkish specimens they are entire. There is, however, an area in eastern Turkey where there occur transitional forms that prevent the recognition of two varieties. The Tournefort specimen (type collection) at BM is of this intermediate form, having sepals entire or with one or two marginal glands.

Sect. 6a. **UMBRACULOIDES** N. Robson

Shrub, deciduous, glabrous, without dark glands; branching lateral. *Stems* 2-lined (?) and ancipitous when young, soon terete. *Leaves* opposite, decussate, sessile, free, deciduous at basal articulation; lamina entire, with venation pinnate, closed, the tertiary densely reticulate; laminar glands punctiform, pale; marginal gland dots pale; ventral glands dense. *Inflorescence* 3–*c.*16-flowered, branching dichasial/monochasial from uppermost node, without subsidiary branches; bracts and bracteoles reduced ?, caducous. *Flowers* stellate, homostylous. *Sepals* 5, free, persistent, with margin entire; veins *c.* 13–15, unbranched; laminar glands linear, pale; marginal glands absent. *Petals* 5, deciduous, apiculus subrounded, margin entire; laminar glands numerous, pale, linear to interrupted. *Stamen fascicles* 5, united 2 + 2 + 1, persistent, with total of 45–50 stamens; filaments united very shortly; anthers yellow, gland amber; pollen type ?

Ovary with 3 axile (?) placentae, ? ovulate; styles 3, free (or partially coherent at first ?); stigma small. *Capsule* not seen.

Basic chromosome number (x): ?; ploidy ?

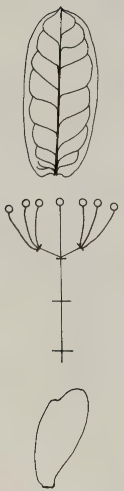
Habitat: unknown.

Distribution: Mexico (Oaxaca).

1 species.

1(64). **Hypericum umbraculoides** N. Robson, **sp. nov.**

H. monogyno affinis, sed sepalis latiuscule oblongo-ellipticis, staminorum fasciculis 2 + 2 + 1 coadunatis post anthesin persistens staminibus in quoque fasciculo paucioribus, stylis tribus liberis vel basin versus breviter coalitis, differt. Type: Mexico, Oaxaca, San Pedro Alto, x.1842, *Liebmann* 3037 (C!, holotype & isotype).



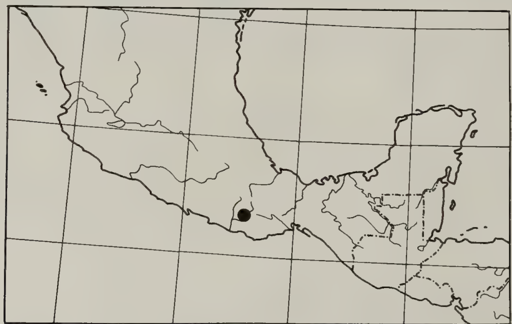
Icon: Fig. 24.

Shrub, deciduous. *Stems* reddish, 2-lined (?) and ancipitous when young, soon terete; internodes 10–20 mm long, shorter than leaves; bark grey, cortex fissuring. *Leaves* sessile; lamina 30–58 × 17–30 mm, oblong to elliptic-oblong, subapiculate to rounded, margin plane, base cordate-amplexicaul, paler beneath, not glaucous, thinly chartaceous; venation: 7–9 pairs main laterals and midrib branches (not distinct), with tertiary reticulation dense, conspicuous, ± prominent beneath; laminar glands varying in size; intramarginal glands dense. *Inflorescence* 3–*c.* 16-flowered, terminal, corymbiform to pseudumbellate, from apical node only; pedicels 6–17 mm long; bracts not seen, caducous. *Flowers* *c.* 22–30 mm in diam., stellate; buds narrowly cylindric-ellipsoid, rounded. *Sepals* 3–4·5 × 2·5–3·5 mm, imbricate, unequal, broadly oblong to ovate-oblong, rounded, margin entire; *c.* 13–15-veined, with veins unbranched, midrib prominent; laminar glands linear. *Petals* golden ? yellow, not tinged red, spreading to reflexed, 14–17 × 7–8 mm, 4–5 × sepals, oblanceolate, with apiculus lateral, subrounded, almost lobiform, margin entire, eglandular. *Stamen fascicles* totalling 45–50 stamens, longest 10–12 mm long, *c.* 0·7 × petals; anthers yellow. *Ovary* 4–5 × 1·5–2 mm, narrowly pyramidal; styles 9·10 mm long, *c.* 2 × ovary, possibly shortly coherent at the base, eventually (or always ?) free, gradually outcurved. *Capsule* and *seeds* unknown. 2n = ?

Habitat unknown.

Mexico (Oaxaca). Map 34.

MEXICO. Oaxaca: San Pedro Alto, x.1842, *Liebmann* 3037 (= Hypericaceae 35) (C).



Map 34 Sect. 6a. *Umbraculoides*: 1. *H. umbraculoides* ●.

Fig. 24 *H. umbraculoides*: (a) habit; (b) leaf section; (c) flower bud; (d) sepal; (e) petal; (f) stamen fasicle; (g) anthers; (h) ovary (a × 1; b × 4; c × 6; d, e, f, h × 8; g × 20). All *Liebmann* 3037.

H. umbraculoides which has as yet been collected only once and appears to be restricted to a small area on the south side of the Cordillera in Oaxaca State, is clearly an ancient relict, its nearest relative (*H. monogynum*, sect. 3) being in China. Its leaf-shape and glandularity, pseudo-umbellate inflorescence and general floral morphology all indicate this relationship, although it is more advanced in having '3' persistent stamen fascicles and 3 styles that are not more than shortly coherent at the base.

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Systematic Index

Accepted names are in roman and synonyms in *italic*; new names are in **bold**, as are principal references. An asterisk (*) denotes a figure.

Notes added in proof

Pp. 170, 171, 214, and figs 4–6. It now seems more likely that the *Hirtella* group (Sects 17–19) is most closely related to the variable *H. oblongifolium*. This alternative view is morphologically more fitting, and the 2n = 24 chromosome numbers in sect. 17. *Hirtella* can then be regarded as primitive in the section.

P. 239. Cultivated material of *H. subsessile* (S.B.E.C. 551, originally identified as *H. acmosepalum*) shows more variation than the two cited specimens, the lower leaves being oblong with a rounded-apiculate apex.

British Museum (Natural History)

Ferns of Jamaica
A guide to the Pteridophytes

G. R. Proctor

This flora records and describes the 579 species and 30 varieties of ferns occurring in Jamaica. The succinct species descriptions include relevant synonymy and incorporate distributional data both within and outside Jamaica. Special emphasis is given to the subtle distinctions between closely related species and all genera are illustrated. Keys to the genera and species facilitate a wider use of the flora in the West Indies and northern South America. The author, one time Senior Botanist in charge of the Herbarium of the Science Museum, Kingston, Jamaica is an outstanding field botanist and his expertise is reflected in the practicality of the flora and especially in the habitat and ecological information. This volume represents an important addition to our knowledge of the flora of the West Indies.

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